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# East Europe Report

SCIENTIFIC AFFAIRS

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# EAST EUROPE REPORT SCIENTIFIC AFFAIRS

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PROBLEMS IN CEMA MICROELECTRONIC COOPERATION NOTED

Busapest HIRADASTECHNIKA in Hungarian No 4, 1983 pp 160-164

[Article by Jan Grzybowski and Jerzy Kusinski, Polish People's Republic: "Several Problems of the Microelectronic Industry Cooperation of the CEMA Countries," after a speech given at the plenary session of the Third Microelectronics Conference of the CEMA Countries held in Siofok, May 1982]

[Text] In recent years the electronics industry has been the fastest growing sector of modern economic life. And this is understandable--around the world the level of development of electronics is both a stimulus to and precondition for economic development. It is worth noting that in the past three 5-year plan periods the sales volume for electronic products increased by an average of 30 percent while consumption of semiconductor parts increased by 100 percent. The integrated circuits industry developed even more strongly; the rate of growth here was 250-300 percent.

It is also easy to see that semiconductor parts in general--and especially integrated circuits--make up an ever greater value proportion in electronic equipment. At this time (according to data pertaining to the USA) this value proportion is about 7 percent; the figure extrapolated to the end of our decade is 12-15 percent.

This value proportion already exceeds 10 percent in Japanese electronic manufacturers are building in LSI parts on an ever greater scale.

In the case of special equipment, such as computer memories, the ICs [integrated circuits] make up 50 or even 80 percent of the entire value of the product.

In accordance with the above, the countries striving for swift economic growth are developing their electronics industries further, especially the research and manufacturing base for ICs.

But the indispensable conditions for success in this area are very precisely performed market surveys and a close check on research and manufacture, because the introduction of new products is not a swift process. It is easily possible that designing a complex new LSI circuit or introducing a new technological process could take so long that the manufacturing firm would lag behind as compared to demand. Developing new products or procedures is very expensive, so the manufacturer pays most dearly for every error made in planning.

What now characterizes the development and trends of products using LSI circuits?

Using the example of pocket calculators, we can observe the saturation of the market for specialized ICs, the subsequent drastic price reductions and—with the exception of the largest manufacturers in the USA and Japan—the disappearance of most firms from the market. The present trend is the development of larger-capacity calculators for scientific, economic, etc applications. It can also be established that universal microprocessor systems are spreading at the expense of the share of specialized computer ICs. Table 1 shows world production of pocket calculators and the value proportion of several types of parts in such devices.

Table 1: World Production of Pocket Calculators and the Value Proportion of Semiconductor Parts in These Products

	1975	1976	1977	1978	1980
Number of calculators (in millions)	42	50	52	53	58
Price of ICs (U.S. dollars)	2.75	1.90	1.30	1.15	0.95
Price of LED display (U.S. dollars)	2.25	1.40	1.00	0.80	0.70
Price of discrete parts (U.S. dollars)	0.25	0.20	0.20	0.15	0.12
Price of all semiconductor parts (U.S. dollars)	5.25	3.50	2.50	2.10	1.77
Total semiconductor market (millions of U.S. dollars)	220	175	130	110	103

The market for semiconductor memories is the most swiftly expanding area for use of LSI and VLSI circuits. This is favored by the standard structure of semiconductor memory segments, which makes possible a higher degree of integration, and the broad applicability of such circuits (among other things, in microprocessor systems used everywhere). At this time the proportion of MOS-RAM memories is the largest (50 percent) among semiconductor memories (taking the amount sold as the base). The trends of development are: increasing memory capacity, with simultaneous reduction of the price per cell unit. One can get 64-K dynamic RAMs on the market; preparations for manufacture of 256-K chips are under way and one counts on their production next year.

Electronic wristwatches provide another example of how large numbers of manufacturing firms disappear from the market with drastic price reductions. The manufacturers of wristwatches with LED displays did especially badly. About half of the watches manufactured around the world are electronic; liquid crystal circuits make up 90 percent of the value of these. The trend of development is to increase the number of functions (services) of electronic watches and to increase the use of microprocessor circuits. Table 2 shows the growth in the production of electronic watches and the development of their prices.

Table 2: Data Pertaining to the World Market for Electronic Watches

	1974	1976	1978	1980
Total production (millions)	1.2	15	60	100
Average price of electronic modules (U.S. dollars)	30	12	6	3
Total value of world production of modules (millions of U.S. dollars)	36	180	360	300
Average price of a watch (U.S. dollars)	125	55	35	25
World production of electronic watches (in millions of U.S. dollars)	150	825	2,100	2,500

Signal technology is increasingly becoming the largest consumer of ICs.

Electronicization of subscribers sets and telephone centers is spreading swiftly and this requires a large number of specialized ICs. Table 3 shows the trends of development in this area.

Table 3. Total Value of Signal Technology Semiconductor Parts Sold Worldwide (in millions of U.S. dollars)

	1974	1976	1978	1980
Bipolar ICs	70	100	200	370
Unipolar ICs	30	100	200	350
Discrete parts	80	140	150	160
Total	180	340	550	880

According to estimates the number of telephone sets in the world will reach one billion by the end of the century and this will result in a corresponding increase in the number of specialized signal technology circuits.

Another significant prospective consumer of electronic products is automobile manufacture. For some manufacturers the value proportion of electronic parts already reaches 12 percent of the price of the car, and is expected to increase to 16-18 percent by the end of the decade. Table 4 shows the growth of the automobile electronics market in the USA in recent years. This area of micro-electronics applications is growing relatively slowly at present. Both technical and economic factors play a role in this. On the one hand electronic parts are still more expensive, in many cases, than the corresponding electromechanical or mechanical parts, and on the other hand the throughput time for planning in the automobile industry is very long.

Table 4. Development of the Automobile Industry Electronics Market in the USA

1975	1976	1977	1978	1979	1980	1982 (prognosis)
50	65	97	120	145	180	240

Despite this, according to the plans, these obstacles will be largely overcome in the second half of the present decade. Partly as a result of technical progress and partly because special, cheap microprocessors and reliable mechanical servomechanisms which can stand up even under the extra-ordinarily harsh operating conditions of automobile will spread.

The sales volume of electronic consumer goods is expected to remain large, but the structure of demand will change significantly. It can be foreseen that during the next 10 years ever larger numbers of multifunctional ICs will be built into electronic consumer goods and that the quality and economy of use of these circuits will improve substantially. A single chip will take care of more and more functions and fewer and fewer auxiliary parts will be needed.

Looking at the parts manufacturing industry as a whole, the following advantages will derive from planning which takes as a base multifunctional ICs (or microprocessors):

- the costs of designing new ICs and realizing new devices will decrease (for example, in the future they will use a total of 4 multifunctional chips in a color TV set in place of the present 11),

- new technical solutions can be optimized better, while series size increases,

- export can increase.

At this time there are two widespread IC manufacturing technologies, bipolar and unipolar. Table 5 shows the division of world IC production according to chief categories and technologies.

Comparing the various categories of MOS circuits, it appears that the swiftest growth was in the NMOS group (primarily due to memories and microprocessor circuits) and in the CMOS group (due to watches and calculators with liquid crystal displays).

The Schottky TTL (TTL-S and TTL-LS) circuits are very swiftly forcing out the TTL circuits, which previously constituted the most important group of bipolar digital circuits, because they are faster and require less power.

The digital MOS circuits have come up as compared to their bipolar corresponding circuits; they are smaller and the number of high-temperature steps needed in the course of manufacture is smaller, making them more suitable for LSI and VLSI technology.

According to the present position of technology, one can put on a single monolithic chip an LSI circuit containing more than 10,000 elements or a VLSI circuit containing 100,000 elements.

Designing and manufacturing such complex circuits means qualitatively new requirements in the areas of computerized design, testing (quality control), manufacture and investment.

Table 5. Division of World IC Production According to Technologies and Designs  
(millions of U.S. dollars)

	1974	1975	1976	1977	1978	1979	1980
Bipolar digital ICs	985	740	905	1,065	1,210	1,305	1,420
of these TTL	720	540	680	810	930	1,005	1,115
DTL	115	85	90	75	70	65	60
ECL	70	60	80	95	110	120	135
Bipolar analog ICs	595	520	710	945	1,130	1,335	1,525
of these professional	335	310	390	550	675	810	915
consumer	260	210	320	395	455	525	610
Unipolar ICs	855	845	1,240	1,540	1,880	2,240	2,620
of these PMOS	660	585	680	645	600	535	510
NMOS	75	140	370	605	925	1,275	1,595
CMOS	120	120	190	290	355	430	515
Total sold in capitalist countries	2,435	2,105	2,855	3,550	4,220	4,870	5,500
Production in vertically integrated firms (capitalist)	400	440	580	705	835	980	1,170
Production of socialist countries	435	415	505	645	750	875	950
TOTAL	3,270	2,960	3,940	4,900	5,805	6,725	7,620

In the view of a number of semiconductor manufacturing firms in the USA and Japan the difficulties in introducing new VLSI chips can be expected primarily in design and secondarily in testing. They mention difficulties connected with development of technological procedures only in third place.

The degree of integration is highest for the memory chips; but they have a standard structure, with repeating cells. Design problems limit the development of other circuit groups with a less regular logical structure (for example, computer or microprocessor circuits). The development of complex VLSI circuits could be made easier if the irregular logical systems could be somehow "organized." Large functional blocks are also needed for libraries or data stores which could be stored in computer memory. Such blocks could be put together with the aid of layers bound into VLSI circuits.

If possible, all those difficulties facing the manufacturers of LSI and VLSI chips should be solved in cooperation with the manufacturers of complete electronic devices, although--as we will see--it may be that the latter will solve them.



One way to make substantial progress in increasing the degree of integration is to place the elements closer together on the chip. A precondition for this is the use of more precise (for example X-ray and electron radiation) lithographic methods. At this time one can call modern those photolithographic procedures which use a projection method with a resolution of 2-3 micrometers. Line structures finer than this can be attained with three new techniques:

--with an improved projection procedure, using remote ultraviolet radiation and quartz substrate masks (a line resolution of 1 micrometer);

--with controlled electron radiation equipment, in which the photoresist is exposed directly on the Si sheet (0.5-micrometer line resolution);

--with an intermediate technique, with operations performed directly on the Si sheet (1-2-micrometer line resolution).

Putting ever smaller units on the surface of the chips also requires the use of thinner and more finely structured layers. And this means that the technological operations must be done at lower temperatures and kept more precisely under control, using non-chemical etching procedures. Ion implantation is replacing the diffusion of doping components.

LSI and VLSI procedures taking the place of SSI and MSI manufacturing technologies have consumed initial investment costs, which increased by orders of magnitude. And as the initial investment costs of the semiconductor industry increase, the profit will be relatively smaller. This circumstance--which is a direct result of the microelectronic technology competition taking place around the world--has led to two phenomena:

1. So-called vertical integration is increasing, as a result of which firms which manufacture only semiconductors are dropping out of the competition while firms which manufacture both semiconductors and electronic equipment are developing. The profit from sale of equipment covers the costs of development of parts manufacture.
2. One can gear up semiconductor industries--or keep up with the leading world firms--only with state support. A number of VLSI circuit research programs in the countries leading in LSI and VLSI technology (the USA, Japan, England, France) were started with government support.

The present development of microelectronics around the world--and especially the entry of certain countries into the club of LSI and VLSI manufacturers--has created or made obvious a number of problems; everyone who wants to deal with the further development of microelectronics must reckon with these:

1. A swift increase in initial investment costs in the event of starting VLSI programs.
2. Vertical integration coming to the fore (uniting parts and equipment manufacture), for the following reasons:

- a. little firms cannot permit themselves the investment costs of VLSI programs,
  - b. the large semiconductor manufacturing firms are beginning to manufacture complete equipment to produce a material base for their VLSI development,
  - c. large firms manufacturing complete equipment are being forced to develop their own parts manufacture.
3. The differences between system design and VLSI chip design are disappearing.
  4. The lack of an experienced work force, which seriously holds back VLSI development, and a relatively small group of experts being in possession of the know-how, which is guarded as a strict secret.
  5. As an answer to the Japanese "challenge," the governments in many countries are "occupying" the semiconductor industry, while poorer countries are less and less able to finance competitive VLSI programs on their own.

With this background, what are the prospects for microelectronics in the CEMA countries?

According to information received from the several socialist countries the situation is as follows:

#### 1. Soviet Union

In the Soviet Union in recent years great importance has been attributed to the development and modernization of electronics. In the majority of cases the trend being implemented is to manufacture microelectronic parts with its own equipment and from its own material according to its own standards, which do not always correspond to industrial world standards.

In our judgment the assortment of analog circuits which can be used in consumer articles is relatively tiny, although mass manufacture of calculators and watches has begun.

According to signed agreements, the Soviet Union and Poland will cooperate on a line of microprocessor circuits and Schottky TTL circuits and they will develop jointly an automated production line for manufacture of LSI and VLSI circuits.

#### 2. GDR

The GDR manufactures both bipolar and MOS circuits. The assortment of MOS circuits is large enough, but they are primarily SSI and MSI circuits manufactured with MNOS technology. The GDR produces 8008 microprocessors in small quantities; it also plans development of a Z-80 system also.

#### 3. Czechoslovakia

In Czechoslovakia standard circuits in the TTL family (also in cooperation with Poland) and analog circuits for both professional and consumer electronics

purposes are manufactured. It has proposed a vigorous development in the line of unipolar circuits. There is talk about circuits for an 8080 A microprocessor system, a series of 1 K RAM memories, 8 K EPROM and 16 K RAM memories and special circuits intended for use in consumer electronic devices. It is preparing to manufacture certain circuits for a bipolar 3000 microprocessor system.

#### 4. Bulgaria

Thus far Bulgaria has not manufactured bipolar circuits; it has specialized in MOS circuits. Calculator, watch and memory circuits figure in the manufacturing spectrum. It plans the development of a microprocessor system--functionally equivalent to the Motorola 6800.

#### 5. Hungary

According to our information, the MOS/LSI program is not yet beyond the laboratory research stage. At the same time, Hungary manufactures several dozen circuit types using imported chips.

#### 6. Romania

The Romanian electronics industry has mastered production of TTL circuits and manufactures several types of analog circuits for use in consumer and professional equipment. According to our estimates, it cannot be expected that Romania will develop manufacture of MOS/LSI circuits in the near future.

#### 7. Poland

According to the prescriptions of the Polish electronics industry development program, Poland will manufacture 70 million ICs (including LSI circuits) in 1985. According to the program the industry must master methods for design, manufacture and testing of VLSI-MOS circuits. The greatest pressure can be felt in the direction of design and manufacture of circuits for microprocessor systems.

Memories make up another important group of circuits. By 1985, according to the plans, it must develop and manufacture a basic series of semiconductor memories, from medium capacity to very large capacity. In the group of TTL logic circuits, the plan includes a series of fast, small-consumption TTL-S and TTL-LS Schottky diodes.

The plans for the group of calculator circuits include three chips for a programmable scientific calculator and an LCD chip in CMOS technology for an engineering calculator.

Several watch circuits will be developed, also in CMOS technology (analog watches, radio and TV clocks and a programmable digital clock).

In the consumer electronic products group, according to the plans, the CEMA countries will develop radio, TV, tape recorder, record player and amplifier circuits, in both bipolar and MOS technologies. As a result of the development

of TV sets expected by around 1985, they will manufacture integrated blocks for these receivers at the LSI level of integration.

Significant progress can be expected--in the areas of both development and manufacture--in a series of professional circuits (operation amplifiers, comparators, voltage regulators).

In the group of signal technology circuits they will manufacture primarily circuits for electronic telephone sets.

The IC circuit development and manufacturing program prescribed by the socialist countries as above, which can be called very broad, has a precondition for its realization not only the research and development base for the circuits themselves but also the assurance of the production of manufacturing and testing equipment, materials and semifinished products.

All of this together is much too difficult a task for a single country, so we must strive for international cooperation. It would be very desirable if the interested CEMA countries were able to come to agreement in regard to the division of labor for the development and manufacture of integrated (especially LSI and VLSI) circuits as soon as possible.

It would be useful, for example, to continue the present cooperation and extend it to microprocessor systems, namely:

in the Soviet and Czechoslovak relationship, to the 3000 system;  
in the Soviet, Polish and Czechoslovak relationship, to the 8080 A, 8085 and 8048 systems;  
for the GDR, to the 800 and Z-80 systems; and  
in the Bulgarian and Soviet relationship, to the 6800 system.

A number of proposals for cooperation were voiced even at the first two Microelectronics Conferences, but very little of this has been realized. We are inclined to see the cause of this in the unfortunate fact that some scientific associations do not rely sufficiently on the findings and resolutions of the Dresden and Torun conferences, which would have provided a method and a foundation for the development of cooperation with the associations of friendly countries.

We consider valid in the present situation the statements made in 1978 and 1980 and the majority of the proposals voiced then pertaining to cooperation among associations.

Going beyond this, the Bulgarian colleagues recommend that the cooperation of the socialist countries in the field of microelectronics should figure as a permanent agenda point at the regular meetings of the presidents and secretaries of the scientific and technical associations of these countries.

According to the proposal of the HTE [Scientific Association of Telecommunications], the leading functionaries of CEMA should be invited to every microelectronics conference of the socialist countries. The Hungarian colleagues

also recommended that a list be prepared of those institutions which might exchange mutual visits and that permanent contact be established among groups of enterprises with similar production profiles. They see the chief obstacle to cooperation in the insufficient nature of the material frameworks.

If we examine the extent to which the conclusions of the preceding conferences have been realized, we get a most unfavorable picture. It can be established also that the degree of realization differs from country to country. If we draw the lessons from how the several associations participated in the preparatory work for the conferences and what their participation was at these conferences, right up to the recent past, we might question the usefulness of continuing the entire initiative. But in the course of the most recent Siofok conference a somewhat more favorable picture seemed to be developing.

After all this, with what method might we improve the efficiency of the realization of those resolutions passed by the most appropriate group?

For our part (speaking personally) we recommend the creation of a permanent inter-association committee, with 2-3 representatives per country, with the task of coordinating or initiating the microelectronics activity of the associations and, further, with the appropriate CEMA institutions, encouraging and supporting cooperation in the development of microelectronics in general in the socialist countries.

The starting point for the work of the committee might be the resolutions of the microelectronics conferences of the socialist countries. Cooperation also seems useful with the appropriate chambers for foreign trade, which in many cases have the material frameworks for support of various activities and for establishing economic, scientific and technical cooperation.

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BRIEFS

INTERKOSMOS SYMPOSIUM--Within the framework of the Interkosmos Program, a session of the Work Group for the Long-Distance Exploration of the Earth opened in Prague on Tuesday. The symposium is attended by prominent scientists from the Soviet Union, the GDR, and Poland. Together with our experts, they will assess the problems connected with the development of equipment for the thermal representation of the earth's surface from planes and artificial satellites. [Text] [Prague RUDE PRAVO in Czech 7 Sep 83 p 2 AU]

MICROELECTRONICS CONFERENCE--the 3-day Third Czechoslovak Conference on Microelectronics with international participation, which opened in Bratislava yesterday, discusses the current scientific-technical problems of microelectronics and its application in practice. The more than 150 participants from Bulgaria, Yugoslavia, Hungary, the GDR, Poland, Romania, the USSR, and the CSSR will familiarize themselves in four sections with the latest findings in microelectronics. [Summary] [Bratislava PRAVDA in Slovak 7 Sep 83 p 2 AU]

NUCLEAR ELECTRONICS CONFERENCE--Current problems of nuclear electronics are the subject of an international conference that opened in Bratislava yesterday. The conference, which is organized by the Comenius University in Bratislava, the Nuclear Research Institute in Dubno near Moscow, and the Czechoslovak and Slovak Academies of Sciences, together with the Tesla enterprises in Piestany and Vrable, is attended by more than 180 experts from the CSSR, Bulgaria, Yugoslavia, Cuba, the DPRK, Hungary, the GDR, the FRG, Poland, Romania, Austria, Switzerland, Italy, the SRV, and the USSR. The week-long conference will deal, among other things, with spectrometrical electronics, with fast processors for the selection of information, and with the use of micro- and small computers in directing physical experiments. [Summary] [Bratislava PRAVDA in Slovak 7 Sep 83 p 2 AU]

CSO: 2402/2

TECHNOLOGICAL INSTITUTE DIRECTOR VIEWS ARTIFICIAL INTELLIGENCE

Prague PRACE in Czech 16 Jul 83 p 4

[Interview with Docent Eng Ivan Plander, Drse, Director of Institute of Technical Cybernetics, by Eng Stefan Kassay, CSc, PhD: "Artificial Intelligence Comes to Life"; date and place not given]

[Text] The Institute of Technical Cybernetics in Bratislava is solving important problems of artificial intelligence. Since these problems are extremely interesting even for nonspecialists, I asked the institute's director, Docent Eng Ivan Plander, DSc, to deal with a wide range of questions.

[Question] Artificial intelligence is engaging the interest of both specialists and laymen. We have long since heard of the possibility of communicating with a computer by means of a special language such as ALGOL and others, but we have not heard much--or rather, we speak of it as science fiction--about the possibility of communicating with a computer in human language. How does this happen?

[Answer] Let me focus on the essential point. The older generation of computers was oriented toward the processing of digital information. Modern computers are oriented somewhat differently in order to make it possible to communicate with them in natural language or in the form of various graphs and images. Thus these are not digital computations, but scientific, technical or economic, computations: i.e., the use of computers in the more extensive work of society.

[Question] We frequently compare the human brain to the computer, or rather the computer to the brain. There is a clear difference in size, but what other fundamental differences are there?

[Answer] There are a good many fundamental differences. Many of them our science has not thus far been able to investigate. Nonetheless, we are attempting to design computers which are capable to some extent of simulating human thinking, and thus of understanding natural speech.

[Question] What is the advantage of communicating with a computer with the human voice or human speech?

[Answer] We have already mentioned the language ALGOL. There are other programming languages too, such as FORTRAN, COBOL AND PL/1: a whole constellation of them. But all of these languages must first be learned in order to use them. In addition, they are specially oriented toward specific use areas. But we want the computer to be usable by everyone in society, not just the chosen who have learned some programming language. Therefore, it is necessary to communicate in a natural language which everyone knows.

[Question] In describing computers we speak of generations: the first generation, let us say, of vacuum-tube computers, then the second, third, and even fifth generation. What awaits us in 20 or 30 years, when we will be relying on artificial intelligence?

[Answer] We are now on the threshold of the fourth generation, even in this country. Abroad, the fifth generation is already being prepared, and it is likely to be in operation in the early 1990's. These will be computers with a high degree of integration, in which on a single silicon wafer base, in a single package, on a single chip, there will be from 1 to 10 million components.

[Question] Perhaps we should add that this chip measures 3 to 5 millimeters.

[Answer] Yes, and sometimes even smaller. This small chip contains a huge number of functional elements. Another advantage is that the fifth-generation computer will already be able to use artificial intelligence in its programs. This is another qualitative aspect which differs from previous computers.

[Question] You have more in mind than miniaturization.

[Answer] This was a technological development. In the past, we classified computers in terms of the technological components used in them: tubes, transistors and integrated circuits. Now a new quality is added: artificial intelligence.

[Question] Let us return to the previous question, for you have not yet answered it fully; let us envision the future.

[Answer] Different designers have different plans and concepts. It is assumed that computers will directly reach the user, i.e., the individual member of society. Everyone will be capable of communicating with the computer or will have one at home. This is the first point. Second, everyone will have the possibility of communicating via telecommunications media with another, larger computer, with an information base where he can find out everything he needs for his work. Thus computers will permeate all of society.



[Question] Now tell us something about the automatic proving of mathematical theorems by means of machines.

[Answer] This is an interesting question, and it will not be simple to answer. I will try to do justice to one aspect of it, the use of the method of proving propositions (theorems) on the specific activities which will have to be carried out by intelligent robots in planning their activity. For the purpose of scheduling and planning the individual steps which they will have to perform (by the method of theorem proving), it is possible to create a procedural plan for the intelligent robot's activity. But as regards theorem-proving itself, I believe that those who work in mathematics and logic will be able to get into it better.

The principle of theorem-proving for planning the work robots, and, obviously, for the creation of specific intelligent systems as well (e.g., expert, consultation, dialog and other systems), which can make an intelligent response to a question put to them, is that theorem-proving establishes the existence of a specific solution, and that a byproduct of this proof (and of the existence of a solution) is some sequence of operations for specific activities. A system (a computer or robot) will carry them out to reach out the goal whose existence was previously proven.

[Question] In the past, and indeed today, the work of the programmer has consisted of representing individual steps as algorithms. When we speak of intelligent machines, can we say that the machine itself converts the elements into algorithms?

[Answer] This is the essence of which I spoke, because previous computers and robots always performed precisely what the programmer had previously placed in their memory.

[Question] You visited Japan, where artificial intelligence is already being applied to industrial robots. What do you know about it?

[Answer] There is an interest in the intelligent robot connected to sensors, specific sense organs, like an eye, or visual subsystem, a tactile subsystem and a motor subsystem. Everything which a man has in himself is connected to the robot as an input device. This means that, figuratively speaking, the robot uses the sense organs to create an image of the external world within its memory. In addition, it operates only in terms of this image, using the theorem-proving method or certain other methods (for this is not the only method). There are many languages which lead to this objective. Then, based on its knowledge of the external environment, it is capable of proceeding like a traveler who plans his route on the map. First it says "I will go there, and then I will go on from there." The only difference is that the robot does not have a complete map, but must create it while en route. It then uses the map to plan subsequent steps. Perhaps a robot has to pass through a maze and get out of it; these methods are also used in such a case.

[Question] Not many people now conceive of the robot as an artificial man. The period during which this conception arose has passed. What does the intelligent robot which you saw in Japan look like, and how does it operate?

[Answer] There is no attempt to create an anthropomorphic robot in the true sense of the word. It is a mechanism which optimally performs certain activities, certain motions, but this activity is more of a scientific research activity. It focuses on simulation of the higher sentient activities of man, on cognitive activity.

[Question] And this is where the close relationship with theorem-proving comes in?

[Answer] Exactly: for a nonliving system to be able to move and to perform specific activities which are not programmed into it in advance, in step-by-step fashion (for it has only a specified objective), and, for it to know the environment in which it must achieve its goal. The environment may change dynamically, in time. It perceives this by its sensors, its sensing organs. On the basis of these, it creates its own solution, which may be completely different for a given objective--for different configurations, external settings and situations. This is not "normal" programming. These are not hereditarily encoded genetic information, so to speak. They are activities of another type and are not placed in man in advance.

[Question] What progress has been made worldwide in artificial intelligence; and where are we, what can we expect, and when?

[Answer] Many organizations in other countries are dealing with these questions. The results are very promising, but they are far from being results that could be generally used in social practice. I assume that the turning point will come in the early 1990's, when these facilities will enter social practice on an immense scale. As to a comparison with our level in Czechoslovakia, let us bear in mind that there is a need to engage in extremely intensive cooperation, and to begin as early as possible. We know that our couriers are not particularly fast, but we need to send them out in advance in order for them to reach the objective in time. We have done this. We know that we are not large. We do not have the material, financial and other capabilities which other countries have. But if we begin working on the solution in good time, we will be able to produce the results which our society needs. Accordingly, this year we set up an international base laboratory in the Institute of Technical Cybernetics. A good deal has already been said about this. Now we are expecting the first specific contacts abroad with regard to specific designs.

[Question] We should add that this will be the leading organization, which will primarily draw upon experience in the Soviet Union.

[Answer] Our colleagues and coworkers in the Soviet Union will be arriving this year from its leading organizations, which in the past have been working very intensively, particularly in the theoretical area. In this way we will add to our theoretical knowledge, while conversely our Soviet colleges will gain something practical and specific from us. We are creating mixed collectives which should be capable of rapidly finding suitable results.

[Question] Nowhere else, perhaps, has progress been as rapid as in electronics. Electronics has brought us more surprises than we could have foreseen in the boldest plans or in forecasts. New professions and new theories are arising--perhaps a theory of systems application. The profession of system engineer is a new one. What is the situation with regard to the architecture of fifth-generation computers?

[Answer] Computer architecture, like building architecture, is a specific structure and organization of computer systems as regards their external and internal construction. The architecture of a computer is in a certain respect dependent on capabilities. The architect of a computer system must design only what he has the conditions and capabilities for in terms of components, designs, accessories, peripherals. It is from these components that the entire structure of the computer is formed.

[Question] Just what is the fifth generation of computers?

[Answer] On the one hand, it stems from technology; we have said that it must be at a high level: a high level of integration, a million or 10 million transistors. The problem is that previous computer architecture, the classical von Neumann architecture (von Neumann was the father of the computer), is outdated and not capable of meeting the requirements which are imposed on future computers. This is particularly true in regard to speed, especially operation execution speed, because the current speed is about a million operations per second. To process tasks related to artificial intelligence, this speed is insufficient. A speed of tens of millions and even billions of operations per second is required. The conventional, classical architecture stemming from von Neumann is a sequential architecture, and will not be usable. Therefore, we are moving to new designs, new methods of laying out the internal structure and the organization of data and instruction flows.

[Question] Then this is architecture in a completely different sense from what we think of in daily life, the external architecture of buildings, but rather is internal architecture involving the byte layout, the layout architecture.

[Answer] In a building, we must know, as soon as we enter it through the main entrance, that we have reached the first floor, that we are coming to further rooms, and so on. This is just how it is realized, although in other categories, in a computer: it is very similar.

[Question] What will the fifth generation bring to human life?

[Answer] It will make it possible to use the computer for activities which were not previously carried out by a computer: we will communicate with it in natural language. We will have to give the computer sentences and words which need not be precise or have a specific syntactic layout. We will be able to speak at will, even in incorrectly formulated sentences. The computer must determine if there is an error, or if there is some insidious problem, and the like. All of this will be possible in such systems. For a system to be capable of conducting this dialog in real time, a million operations per second is far too few.

[Question] Would you try to give us an idea of your personal desire in this area? As a scientific worker and a director, you must have your work ambitions. What would you like to achieve or see in 10 or 15 years, let us say?

[Answer] I would like to see fifth-generation computers, extremely fast parallel computers, in operation, not in 10 years, but even sooner. We already have them on paper and in theoretical studies. Obviously this is not enough. We need to have these computers in operation, working, and of course producing, helping us with our economic and technical problems. We have worked out designs of this sort, and they are extremely interesting. When we speak of fifth-generation computers, there is another aspect, namely distributed computer systems, in which separate computers communicate with each other.

8480

CSO: 2402/60

SENSOR TECHNOLOGY FOR SECOND, THIRD GENERATION INDUSTRIAL ROBOTS

Optical Sensor Applications

Leipzig URANIA in German Vol 33 No 8, Aug 83 (signed to press 29 Jun 83)  
pp 12-16

[Article by Dietmar Otto, graduate engineer: "More Effective Management With Industrial Robots"]

[Excerpts] Wherever in industrial countries better management and higher productivity are discussed today, industrial robots (IR) are in use to some degree. They make possible low-manpower production, a higher efficiency margin and--what especially counts for socialism--the dissolution of body-taxing, monotonous and health-endangering jobs. Since the Tenth SED Convention, the inventory of robots in our factories has increased by a factor of 3.4 percent; at the end of February 23,639 industrial robots were in service. Expressed in this are a good development and a healthy adjustment in the GDR to this new agency of automation although the manifold application of IR is to be further accelerated in order to fulfill this year's plan tasks and to attack 1984's tasks in a timely manner. Of special importance--and so decreed during the Sixth Meeting of the SED Central Committee--is the "multishift tasking of the available industrial robots in our economy and the associated release of manpower to do other jobs." Industrial robots take on special significance in rationalization projects wherein they are used with microelectronic systems to modernize available production facilities so "that highly productive technologies and processes with great economic effect can be made effective in the shortest possible time." Industrial robots of the next generations give us the potential to still more effectively structure the production processes. What can these industrial robots do, especially those of the next, the second generation?

From previous articles it is known that IR's can execute as often as required and with appropriate accuracy clearly describable geometric work processes and manipulative motions. In this class of motions are the loading and unloading of parts into or out of the machining enclosure of a machine tool or the execution of a specified tool motion as in grinding or deburring work. However in automating complicated production

process for the purpose of setting up automatic, low-manpower production in those areas where the human operator must skillfully use his senses, neither process-specific nor process-flexible IR's are satisfactory. Here robots with "intelligence" are required, industrial robots which possess sense organs (sensors) and brains (microcomputers).

#### Proximity Sensors

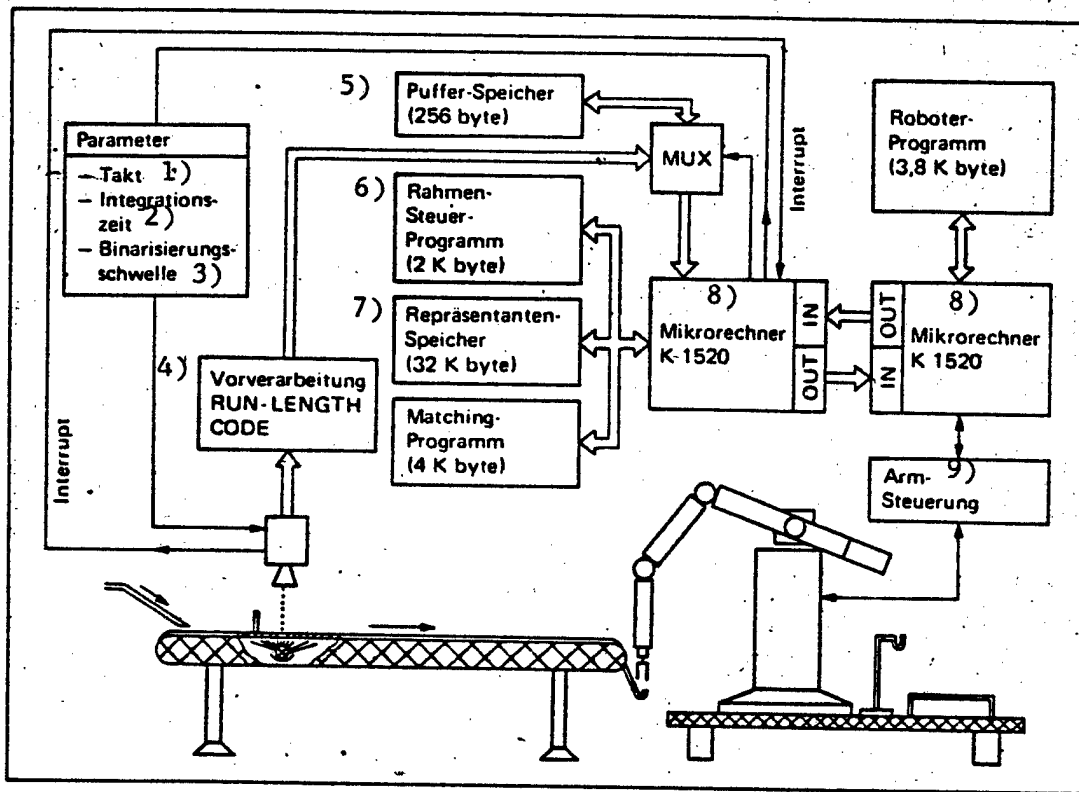
Proximity sensor systems respond to physical effects such as changes in capacitance, resistance, light intensity, sound waves, etc. The Central Institute for Welding Technology, Halle, has developed and put into production a number of effective sensors for the welding field. The photo shows a fillet-weld symmetry sensor which assures precise welding torch positioning during open-arc fillet welding. Its principle involves evaluation of the electromagnetic radiation which radiates from the arc during the welding process (evaluation of differences in light intensity). The reflection of the arc is, as the picture shows, picked up laterally on both sides by the flank plates being welded and the light intensity values are converted to electrical values via photo resistors. Two fiber optics cables enclosed in aperture tubes running alongside the torch are aimed at the area of the arc. The electrical conversion of the signals, evaluation and signal conditioning for guiding the axis of the torch take place in the sensor head.

#### Optical Sensors

Up to this point optical (visual) sensors are preferred among the proximity sensors due to their broad applicability. They are the distinguishing feature of IR's of the second generation. To some degree, one can make an analogy between IR optical systems and eye-brain coordination in human beings. The optical system determines the intelligence of the IR and hence its flexibility. Optical sensor systems have already been used in some areas for quite a while. Representative uses include processing of fluorographic pictures, automatic character recognition and the evaluation of satellite photographs. Conceivably, they can be used to solve many technical problems in the complex and flexible automation of processes. For photographing the IR field of view, both TV cameras and special cameras with lines or matrices of photosensitive elements can be use. The picture is read--raster scanned--in a form suitable for processing in the accompanying computer. The microcomputer processes this information in seconds in accordance with its stored programs for the purpose of flexibly controlling the IR. The IR has thus perceived and processed its environment. In the matrix solid state camera, for example, the sensor elements consist of a microelectronic component known as a charge coupled device on which several picture elements (pixels) can be carried along with signal preprocessing circuits. In the figure on page 14, video signals are represented schematically for line and matrix sensors. Internationally there is a broad selection of CCD cells (up to 2048 x 1 pixels) and of CCE matrices (up to 640 x 480 pixels). Visual systems can be assembled as 2-D, 2-1/2-D and 3-D systems. The most highly developed are 2-D systems (see URANIA 6/81).

The first CCD solid state cameras coupled with IR's were put into service in the GDR. An example is the line camera developed by the AdW of the GDR based on CCD line type L 110 with 256 x 1 pixels. It was coupled, for instance, with the PHM4 industrial robot from VEB Combine Robotron. This second-generation IR does assembly work in the precision equipment industry. A newer camera design variant has been developed in the VEB Combine Communications Technology, Studio Technology Division in Berlin. This type ZFK 1020 CCD line camera will be of importance in automating many processes. Two subsystems developed in connection with this program were a) the complete visual sensor system as a module to be inserted as a variant into the dismounted camera head and b) a circuit board in format K 1520. Utilization structures and examples can be seen in the graphics on p 17. It is a fact however that in the use of CCD line cameras for scene recognition a relative motion between camera and object is necessary for evaluating a planar picture.

Many questions are still open. There is however no doubt that industrial robots combined with microelectronics yield the most important agency for automating entire production segments. But we have to apply them objectively and have to objectively modernize, expand and reorganize technological processes and generalize technical innovations even faster than before. Above all, before introducing industrial robots in a new situation, the production organization has to be structured to interact with robots so that there will be no economic loss. Practical experience confirms the fact that not every robot has to possess the highest possible level of technical perfection with respect to its spectrum of application. This means: It only has to be able to do what the technological process requires. A smart combination of all automation media brings the highest effectivity and productivity--the prerequisite for being able to successfully realize the economic strategy of the 1980s.



Structural schematic of the visual recognition system coupled with the PHM4 IR

Key to Figure:

- |                                  |                           |
|----------------------------------|---------------------------|
| 1. clock                         | 6. frame control program  |
| 2. integration time              | 7. reference image memory |
| 3. binary encoding threshold     | 8. microcomputer          |
| 4. preprocessing run length code | 9. arm controller         |
| 5. buffer memory                 |                           |

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# Current R & D Aims

East Berlin MESSEN-STEUERN-REGELN in German Vol 26 No 2, Feb 83 pp 95-99

[Article by Prof V. Kempe, Berlin, "Sensor Technique for Second and Third Generation Industrial Robots (Part II)"]

[Exerpt] The research and development work in the GDR in the field of sensor technology for industrial robots is characterized by three areas of focus:

--Adaptation of available sensors to various sample application cases for industrial robots of the second generation,

--development of new sensors and sensor systems (especially simple force sensors; RCC links; pneumatic, optical and infrared proximity sensors; visual recognition systems) and application within the scope of the sample application cases for robots of the second generation,

--sensor systems for industrial robots of the third generation including equipment and programming techniques for information processing and utilization; focus is on visual sensor systems.

An international research objective which is projecting more and more into the foreground is the conception and development of modular sensor building blocks with uniform design and electrical interfaces, standardized interface units and a modular programming system for information evaluation and derivation of control signals for the various control levels.

9160

CSO: 2302/4

BIOGRAPHIES OF POLISH ACADEMY OF SCIENCE MEMBERS

Warsaw CZLONKOWIE POLSKIEJ AKADEMII NAUK - INFORMATOR in Polish 1982 pp 5-151

[Text] Preface

This second edition of the "Członkowie Polskiej Akademii Nauk" [Members of the Polish Academy of Sciences] guidebook is appearing during the second year of the 11th term of the PAN [Polish Academy of Sciences] Presidium, encompassing the years 1981-1983. It takes into consideration the changes that have taken place during the past 3 years.

The guidebook includes a listing of the PAN members that have been elected to the PAN authorities during the current term, a brief biography and photograph of PAN members in Poland, concise data on foreign PAN members and a listing of deceased members in Poland and abroad.

The data on PAN members has been expanded in the current edition. Their biographies include the following data: first and last names, date of birth, date of admittance into PAN, participation in the work of the PAN Presidium, academic specialty, title and academic degrees, honorary doctorates, membership in foreign academies of sciences, honorary membership in scholarly associations, office-holding in international organizations, state prizes obtained, current place of work and position held and business and home addresses.

We are supplementing the previous data with the most indispensable general information: on the kinds of PAN membership, the method of adding to the PAN membership and the rights and duties of PAN members.

In accordance with the law on PAN that has been in effect since 1970, the academy is composed of regular and corresponding national members and foreign members. The regular and corresponding members have identical rights and duties, with the qualification that only a regular member may be elected president or vice president of PAN.

It should be added here that the first (1951) law on PAN stipulated two categories besides regular and corresponding members: honorary and titular members. Both of these categories, however, were dropped by a 1960 PAN law. No honorary members were ever appointed, and the 41 titular members that were included in the first PAN group in 1952 later were elected regular members.

The corporate nature of PAN as a self-governing association of scholars is based on the fact that new members are selected by current members. The code of regulations outlines the detailed procedure for nominating and electing PAN members. The most important change in this area, introduced in 1970, is the expansion of the circle of institutions authorized to nominate candidates to PAN. Before 1970, only academy members enjoyed that right, that was extended in 1970 to scientific councils of PAN branches, scientific-research institutes, scientific councils or the councils of the sections of organizational units of higher schools that have the authority to award doctor habilitatus degrees.

The PAN General Assembly elects all PAN members by secret ballot. Only a Polish citizen may be a national member of PAN. Only scholars that are not Polish citizens may be elected foreign members of PAN. The election of members by the PAN General Assembly is subject to confirmation by the Council of State.

The composition of the academy from 1954 (when the first elections of members were held) until 1981 was supplemented 30 times (elections of new national members were conducted 16 times and elections of foreign members were held 14 times). The policy of supplementing the make-up of the academy primarily was aimed at taking into consideration the criteria of scholarly excellence of candidates combined with the developmental needs of all national scholarly communities. In order to ensure that the various scholarly fields are represented properly, especially new, developing disciplines, the PAN Presidium determines how many new members may be elected during a given year and apportions places among the particular fields of knowledge. The Presidium publishes these decisions in the general and professional press.

Table 1. PAN Membership Figures as of 31 July 1982

<u>Sections</u>	<u>National Members</u>			<u>Foreign Members</u>
	<u>total</u>	<u>regular</u>	<u>corres- ponding</u>	
Total	295	161	134	114
Section I--Social Sciences	49	31	18	21
Section II--Biological Sciences	32	17	15	13
Section III--Mathematical, Chemical and Physical Sciences	66	33	33	26
Section IV--Technical Sciences	58	30	28	21
Section V--Agricultural and Forestry Sciences	31	18	13	13
Section VI--Medical Sciences	32	18	14	15
Section VII--Earth and Mining Sciences	27	14	13	5

Besides having the character of the highest scholarly distinction, election to PAN membership obliges one to take an active part both in research and in PAN organizational work.

The law in effect on PAN proclaims that the academy unites eminent scholars for the purpose of creative scholarly work and the execution of academy tasks and outlines more specifically the following duties of PAN members: national members of the academy are obliged to conduct scholarly work emanating from the plans of PAN or higher schools and other scientific-research institutions, to train new scholarly cadres, to take part in the work of the General Assembly, their own sections, branches; scholarly committees, institutional scholarly councils and commissions and to submit reports of their work to the appropriate PAN sections.

In recent years, the policy of the academy authorities has aimed toward creating for academy members the best conditions possible for scholarly work, toward making more and more extensive use of their knowledge, talent and experience and toward increasing their impact upon the creation of state academic policy and decisions on academic questions by entrusting to them the functions of organizing and creating national research programs.

This policy will continue to be practiced and strengthened in conformity with the operational program of PAN authorities. PAN is able to perform its numerous, difficult tasks only when its ranks contain the most eminent scholarly authorities; when it creates circumstances that enable the transformation of individual authorities and initiatives into group authorities and initiatives; when its members and collective organs will maintain unquestionable impartiality in assessing the situation and the needs of Polish scholarship, and its creative achievements and social work will gain for it respect and trust.

Authorities of the Polish Academy of Sciences for the 1981-1983 Term

#### PAN Presidium

President	regular member of PAN Aleksander GIEYSZTOR
Vice President	regular member of PAN Jan Karol KOSTRZEWSKI
Vice President	regular member of PAN Jerzy LITWINISZYN
Vice President	regular member of PAN Leonard SOSNOWSKI
Vice President	regular member of PAN Maciej WIEWIOROWSKI
Scientific Secretary	regular member of PAN Zdzislaw KACZMAREK
Members:	regular member of PAN Adam BIELANSKI
	corresponding member of PAN Mieczyslaw CHORAZY
	corresponding member of PAN Bohdan CISZEWSKI
	regular member of PAN Wladyslaw FISZDON
	regular member of PAN Wacław GAJEWSKI
	regular member of PAN Kornel GIBINSKI
	regular member of PAN Janusz HAMAN
	corresponding member of PAN Alfred JAHN
	regular member of PAN Bogusława JEZOWSKA-TRZEBIATOWSKA
	regular member of PAN Zofia KIELAN-JAWOROWSKA

regular member of PAN Stefan KIENIEWICZ  
 regular member of PAN Wlodzimierz KOLOS  
 regular member of PAN Gerard LABUDA  
 regular member of PAN Henryk MARKIEWICZ  
 regular member of PAN Wladyslaw MARKIEWICZ  
 corresponding member of PAN Alojzy MELICH  
 regular member of PAN Jan MICHALSKI  
 corresponding member of PAN Miroslaw MOSSAKOWSKI  
 corresponding member of PAN Witold NOWACKI  
 corresponding member of PAN Wlodzimierz OSTROWSKI  
 regular member of PAN Szczepan PIENIAZEK  
 regular member of PAN Henryk SZARSKI  
 regular member of PAN Roman TEISSEYRE  
 regular member of PAN Andrzej TRAUTMAN  
 corresponding member of PAN Adam Urbanek  
 regular member of PAN Wladyslaw WEGOREK  
 corresponding member of PAN Jozef WIECKOWSKI  
 regular member of PAN Stefan ZOLKIEWSKI

First Deputy  
 Scientific Secretary      corresponding member of PAN Zbigniew GERTYCH

Deputy Scientific  
 Secretary      regular member of PAN Maciej NALECZ

#### Section I--Social Sciences

Section Secretary      regular member of PAN Wladyslaw MARKIEWICZ  
 Deputy Secretary  
 of the Section      corresponding member of PAN Henryk CHOLAJ  
 Deputy Secretary  
 of the Section      Docent Doctor Leszek KUBICKI

#### Section II--Biological Sciences

Section Secretary      corresponding member of PAN Adam URBANEK  
 Deputy Secretary  
 of the Section      Prof Dr Kazimierz KLECZKOWSKI  
 Deputy Secretary  
 of the Section      Prof Dr Przemyslaw TROJAN

#### Section III--Mathematical, Physical and Chemical Sciences

Section Secretary      regular member of PAN Wlodzimierz KOLOS  
 Deputy Secretary  
 of the Section      corresponding member of PAN Ryszard SOSNOWSKI  
 Deputy Secretary  
 of the Section      Prof Dr Marian MIKOLAJCZYK

#### Section IV--Technical Sciences

Section Secretary	corresponding member of PAN Bohdan CISZEWSKI
Deputy Secretary of the Section	corresponding member of PAN Tadeusz SLIWINSKI
Deputy Secretary of the Section	Doc Dr Zenon SZODA

#### Section V--Agricultural and Forestry Sciences

Section Secretary	regular member of PAN Janusz HAMAN
Deputy Secretary of the Section	corresponding member of PAN Saturnin ZAWADZKI
Deputy Secretary of the Section	Prof Dr Franciszek WITCZAK

#### Section VI--Medical Sciences

Section Secretary	corresponding member of PAN Mirosław KOSSAKOWSKI
Deputy Secretary of the Section	corresponding member of PAN Witold RUDOWSKI
Deputy Secretary of the Section	corresponding member of PAN Adam NOWOŚLAWSKI

#### Section VII--Earth and Mining Sciences

Section Secretary	regular member of PAN Roman TEISSEYRE
Deputy Secretary of the Section	Prof Dr Bolesław MALISZ
Deputy Secretary of the Section	Doc Dr Michał SZULCZEWSKI

#### Branches of the Polish Academy of Sciences

##### in Gdansk

President	corresponding member of PAN Józef WIECKOWSKI
Vice President	corresponding member of PAN Tadeusz KRZYMOWSKI
Vice President	regular member of PAN Piotr ZAREMBA
Scientific Secretary	corresponding member of PAN Czesław DRUET
Deputy Scientific Secretary	corresponding member of PAN Włodzimierz PROSNAK

##### in Krakow

President	regular member of PAN Jerzy LITWINISZYN
Vice President	regular member of PAN Henryk SZARSKI
Scientific Secretary	corresponding member of PAN Włodzimierz OSTROWSKI
Deputy Scientific Secretary	corresponding member of PAN Antoni S. KLECZKOWSKI
Deputy Scientific Secretary	corresponding member of PAN Emanuel ROSTWOROWSKI

in Katowice

President  
Vice President  
Scientific Secretary  
Deputy Scientific  
Secretary

corresponding member of PAN Alojzy MELICH  
regular member of PAN Tadeusz ZAGAJEWSKI  
corresponding member of PAN Wacław SAKWA  
corresponding member of PAN Henryk BYSTRON

in Łódź

President  
Vice President  
Scientific Secretary  
Deputy Scientific  
Secretary

regular member of PAN Jan MICHAŁSKI  
regular member of PAN Edward ROSSET  
corresponding member of PAN Zygmunt LASOCKI  
Prof Dr Andrzej NADOLSKI

in Poznań

President  
Vice President  
Scientific Secretary  
Deputy Scientific  
Secretary

regular member of PAN Władysław WEGOREK  
regular member of PAN Jerzy PAWEŁKIEWICZ  
corresponding member of PAN Witold MICHAŁKIEWICZ  
corresponding member of PAN Jan STANKOWSKI

in Wrocław

President  
Vice President  
Scientific Secretary  
Deputy Scientific  
Secretary

regular member of PAN Bogusława JEZOWSKA-TRZEBIATOWSKA  
regular member of PAN Hugon KOWARZYK  
corresponding member of PAN Ludwik BADIAN  
regular member PAN Bohdan STALINSKI

#### NATIONAL MEMBERS

##### Section I--Social Sciences

###### Regular Members

Henryk BARYCZ, born 26 June 1901

regular member 1973

history of culture

retired full professor, Jagiellonian University in Kraków, Dr of Philosophy

member of: International Academy of Historical Sciences (regular)

foreign member of: Bologna Adam Mickiewicz Academy of Polish and Slavic

History and Literature

[address] Juliusz Słowacki Street No 15, apt 2, 31-159 Kraków

Mieczyslaw BRAHMER, born 26 January 1899  
corresponding member 1958, regular member 1964  
Romance language studies, history of the theater  
retired full professor, Warsaw University, Dr of Philosophy  
Dr h.c. [honoris causa], University of Naples  
foreign member of: Padua Academy of Science, Literature and Art, Bologna  
Adam Mickiewicz Academy of Polish and Slavic History and Literature,  
International Association of Comparative Literature (AILC), vice president  
1961-1964  
[address] Seweryn Street No 6, apt 9, 00-331 Warsaw

Witold CZACHORSKI, born 29 June 1915  
corresponding member 1971, regular member 1980  
civil law, comparative civil law  
full professor, Dr of Jurisprudence  
Dr h.c., University of Ghent, UMCS [Marie Curie-Sklodowska University] in  
Lublin  
member of: International Academy of Comparative Law (regular), the Hague  
Warsaw University Institute of Civil Law, Krakowskie Przedmiescie No 26/28,  
00-325 Warsaw, telephone 20-03-81, extension 532, 472  
[address] Kredytowa Street No 8, apt 55, 00-062 Warsaw

Kazimierz DOBROWOLSKI, born 20 December 1894  
corresponding member 1962, regular member 1969  
sociology, ethnology, history of culture  
retired full professor, Jagiellonian University in Krakow, Dr of Philosophy,  
Dr of History  
Dr h.c.: University of Bratislava  
honorary member of: Western Institute, Polish Ethnographic Society, Hungarian  
Ethnographic Society  
State award: individual; second degree 1966  
[address] Gontyna Street No 2, 30-203 Krakow

Aleksander GIEYSZTOR, born 17 July 1916  
corresponding member 1971, regular member 1980; member of PAN Presidium and  
president 1981--; Palace of Culture and Science, 00-901 Warsaw, telephone  
20-33-53  
history of the Middle Ages and auxiliary historical studies  
Dr h.c., University of Aix-en-Provence, University of Bordeaux, University of  
Budapest, University of Moscow, the Sorbonne in Paris  
foreign member of: American Medieval Studies Academy, Cambridge, Mass.,  
European Academy of History, Institute of France (Acad. d'Inscriptions et  
Belles-Lettres), Belgian Royal Academy, Belgian Royal Academy of Science,  
Literature and Fine Arts, Bordeaux National Academy of Science, Literature  
and the Arts  
honorary member of: Plock Scientific Society  
International Committee for Historical Studies (ICHS), first vice president  
1975-1980, president 1980--  
state award: group; second degree 1950  
Warsaw University Historical Institute, Krakowskie Przedmiescie No 26/28,  
00-325 Warsaw, telephone 26-19-88



director, Royal Castle, Zamkowy Place, 00-267 Warsaw, telephone 31-91-99,  
38-48-92

[address] Wilcza Street No 8, apt 20, 00-532 Warsaw

Konrad GORSKI, born 22 April 1895

regular member 1969

history of Polish literature

retired full professor, Mikolaj Kopernik University in Torun, Dr of Philosophy

Dr h.c.: U.J. [Jagiellonian University] Krakow, KUL [Catholic University

of Lublin] Lublin, University of Torun

foreign member of: Bologna Adam Mickiewicz Academy of Polish and Slavic

History and Literature

honorary member of: Pomorze Musical Society, Adam Mickiewicz Literary Society

Editorial-Textological Commission of the International Congress of Slavists,

chairman 1958--

[address] Bydgoska Street No 14, 87-100 Torun

Witold HENSEL, born 29 March 1917

corresponding member. 1965, regular member 1973

prehistorical archeology and archeology of the early Middle Ages

foreign member of: GDR Academy of Sciences, Macedonian Academy of Sciences  
and the Arts

honorary member of: Wojciech Ketrzynski Center for Scientific Studies in  
Olsztyn, Polish Archeological and Numismatic Society, Union of Yugoslavian  
Archeological Societies

International Committee for Studying City Origins, president 1962-1978;

International Committee of Slavists, vice president 1971--; International

Union for Slavic Archeology (IUAS), president 1965-1967, vice president 1968--

state award: individual; second degree 1955, 1966

director, PAN Institute for the History of Material Culture, Karol Swierczewski  
Blvd. No 105, 00-140 Warsaw, telephone 24-01-00

[address] Marszalkowska Street No 84/92, apt 109, 00-514 Warsaw

Henryk JABLONSKI, born 27 December 1909

corresponding member 1952, regular member 1956; member, PAN Presidium 1955-1971,

PAN scientific secretary 1955-1965, PAN vice president 1966-1971

contemporary and modern history of Poland

retired full professor, Warsaw University, Dr of History

Dr h.c.: University of Budapest, UJ Krakow, University of Lodz, University

of Moscow, Wroclaw University, WSE [Higher School of Economics] Wroclaw

foreign member of: Academy of Sciences of the Mongolian People's Republic,

USSR Academy of Sciences, Academy of the Socialist Republic of Romania,

Czechoslovakian Academy of Sciences, Mexican Academy of History

honorary member of: Polish Historical Society, Polish Archivists Association,

Friends of Science Society in Legnica

state award: individual; second degree 1955; individual first degree 1964,

Special Award 1979

chairman, Council of State

[address] Belvedere, 00-591 Warsaw

Stefan KIENIEWICZ, born 20 September 1907  
corresponding member 1965, regular member 1969, member, PAN Presidium 1981--  
19th and 20th century Polish history  
retired full professor, Warsaw University, Dr of Philosophy  
Dr h.c.: UMCS in Lublin  
foreign member of: Hungarian Academy of Sciences (honorary)  
honorary member of: Polish Historical Society  
state awards: individual; third degree 1952, individual; second degree 1955,  
1964, individual; first degree 1978  
[address] Wiktorska Street 83/87, apt 32, 02-582 Warsaw

Wladyslaw KURASZKIEWICZ, born 22 February 1905  
corresponding member 1967, regular member 1973  
Polish and Slavic studies  
retired full professor, Adam Mickiewicz University in Poznan, Dr of Philosophy  
honorary professor: University of Cologne  
honorary member of: Polish Linguistic Society, Poznan Society of Friends of  
Science  
state award: individual; second degree 1955  
[address] Kanclerska Street No 15, 60-327 Poznan

Gerard LABUDA, born 28 December 1916  
corresponding member 1964, regular member 1969; member, PAN Presidium 1972--,  
chairman, PAN branch in Poznan 1972-1980  
general history of the Middle Ages  
full professor, Dr of Humanistic Studies  
foreign member: GDR Academy of Sciences  
state awards: individual; third degree 1949, 1951, group; first degree 1970  
director, PAN Institute of History Board on the History of Pomorze,  
Zwierzyniecka Street No 20, 60-814 Poznan, telephone 4-44-55  
[address] Kanclerska Street No 8, 60-327 Poznan

Manfred LACHS, born 21 April 1914  
corresponding member 1960, regular member 1973  
international law  
full professor Warsaw University, Dr of Jurisprudence (UJ), Dr (University  
of Nancy), Dr of Legal Studies (M[ihail] Lomonosov Moscow State University)  
Dr h.c.: University of Algiers, University of Brussels, University of Budapest,  
Univ. of Bucharest, Univ. of Delhi, Univ. of Halifax, Univ. of Helsinki,  
Univ. of London, Univ. of Nice, New York University, Univ. of Sofia,  
Univ. of Southampton, Univ. of Simon Fraser in Vancouver, Howard Univ.,  
Washington D.C.  
member of: International Academy of Astronauts, Paris (honorary)  
foreign member of: Bologna Academy of Ethical Studies, Academy of Ethical  
and Political Studies of the Institute of France, Hague Academy of International  
Law, Mexican Academy of International Law  
honorary member of: American Society of International Law in Washington,  
Indian Society of International Law  
Academy of International Law, vice president 1976--; Legal Committee, UN  
General Assembly, chairman 1949, 1951, 1953; Legal Committee on Cosmic Space  
of the UN, chairman 1962-1967; Council of the UN Research Institute,

vice president 1977-1980; International Tribunal of Justice, president 1973-1976, judge in the International Court of Justice, the Hague  
[address] Cour Internationale de Justice, Palais de la Paix, La Haye, Holland

Edward LIPINSKI, born 18 October 1888  
titular member 1952, regular member 1957  
political economics  
retired full professor, Main School of Planning and Statistics [SGPiS], Warsaw and Warsaw University  
Dr h.c.: SGPiS, Warsaw  
foreign member of: British Academy  
honorary president of: Polish Economic Society [PTE], International Society for Economics Studies (IEA)  
state awards: individual; second degree 1955; individual; first degree 1972  
[address] Rakowiecka Street, No 22c, apt 26, 02-521 Warsaw

Stanislaw LORENTZ, born 28 April 1899  
corresponding member 1952, regular member 1964  
history of modern art  
retired full professor, Warsaw Univeristy, Dr of Philosophy  
Dr h.c.: Univ. of Bordeaux, Univ. of Nancy  
foreign member of: Venice Academy of Fine Arts, National Academy of Science, Literature and the Arts, Bordeaux  
honorary president of: International Center of Studies for the Preservation and Restoration of Cultural Monuments in Rome  
honorary member of: Art Historians Society, International Committee for Art History (CIHA), International Museums Council (ICOM), International Council on Historic Monuments and Historic Districts (ICOMOS)  
International Center for Research in the Field of the Preservation and Restoration of Historic Monuments in Rome, vice president 1958-1964, president 1965-1971  
state awards: group; second degree 1952, 1955, individual; first degree 1964, Special Award 1979  
director of the National Museum in Warsaw, Jerozolimski Blvd. No 3, 00-495 Warsaw, telephone 21-81-95  
[address] Jerozolimski Blvd. No 3, 00-495 Warsaw

Henryk LOWMIANSKI, born 10 August 1898  
corresponding member 1952, regular member 1956  
history of the peoples of the USSR, medieval studies  
retired full professor, Adam Mickiewicz University in Poznan, Dr of Philosophy  
Dr h.c.: Univ. of Poznan, Warsaw University  
state awards: individual; first degree 1955, 1964  
[address] Czesnikowska Street No 12, apt 1, 60-330 Poznan

Henryk MARKIEWICZ, born 16 November 1922  
corresponding member 1965, regular member 1976, member, PAN Presidium 1981--  
history of Polish literature, literary theory  
full professor, Dr of Polish Studies  
state award: group; second degree 1951  
director, UJ Institute of Polish Studies, Krakow, Golebia Street No 20, 31-007 Krakow, telephone 22-10-33, extension 343  
[address] Artur Grottger Street No 1, apt 6, 30-035 Krakow

Wladyslaw MARKIEWICZ, born 2 January 1920  
corresponding member 1971, regular member 1976; member, PAN Presidium and  
secretary, Section I--Social Sciences, PAN 1972--; Palace of Culture and  
Science, 00-901 Warsaw, telephone 20-33-52  
sociology  
full professor, Dr of Humanistic Studies  
Institute of Sociology, Warsaw University, Karowa Street 18, 00-324 Warsaw  
telephone 27-85-99  
[address] Wiejska Street No 18, apt 13, 00-490 Warsaw

Edward ROSSET, born 4 November 1897  
corresponding member 1962, regular member 1976; vice president of the Lodz  
PAN branch 1978--; Boczna Street No 5, 90-362 Lodz, telephone 4-16-00  
demography and statistics  
retired full professor, Lodz University, Dr of Jurisprudence  
Dr h.c.: Univ of Lodz  
honorary member of: W. Ketrzynski Center for Scientific Studies in Olsztyn,  
Polish Gerontological Society, Polish Free University Society, Czechoslovakian  
Demographic Society, Italian Committee for Population Problem Research  
European Center for Population Research (CEEP), vice president 1971-1976  
state award: individual; first degree 1976  
[address] Aleksander Zelwerowicz Street No 34, 90-147 Lodz

Jan SAFAREWICZ, born 8 February 1904  
corresponding member 1958, regular member 1964  
Indo-European linguistics  
retired full professor, UJ in Krakow, Dr of Philosophy  
Dr h.c.: Univ of Wilno  
[address] Wladyslaw Lokietek Street No 1, apt 1, 30-010 Krakow

Adam SCHAFF, born 10 March 1913  
corresponding member 1952, regular member 1961; member, PAN Presidium 1960-  
1968  
philosophy  
full professor, Dr of Philosophical Studies  
Dr h.c.: Univ of Ann Arbor [as published], the Sorbonne, Paris  
foreign member of: Bulgarian Academy of Sciences  
state awards: individual; second degree 1951; individual; first degree 1955,  
1964  
head, Institute on Theory of Knowledge, PAN Institute of Philosophy and  
Sociology, Staszic Palace, Nowy Swiat Street No 72, 00-330 Warsaw, telephone  
26-52-31 extension 165  
honorary professor of: Univ of Vienna  
chairman, Council of Directors, European Center for Social Sciences in Vienna  
[address] First Army of the Polish Army Blvd, No 2/4 apt 24, 00-582 Warsaw

Kazimierz SECOMSKI, born 26 November 1910  
corresponding member 1960, regular member 1966; member, PAN Presidium 1969-1980, deputy scientific secretary, PAN 1969-1971  
planning and socioeconomic policy  
retired full professor, SGPiS, Dr of Economic Sciences  
Dr h.c.: Warsaw Univ, WSE Poznan  
foreign member of: Czechoslovakian Academy of Sciences  
state awards: individual; second degree 1970, individual; first degree 1974  
deputy chairman, Council of State  
[address] Tadeusz Boy Zelenski Street No 6, 00-621 Warsaw

Stefania SKWARCZYNSKA, born 17 November 1902  
corresponding member 1971, regular member 1976  
theory of literature, theater and film  
retired full professor, Lodz University, Dr of Philosophy  
Dr h.c.: Lodz University  
honorary chairperson of: Slavic Poetics and Stylistics Commission, International Committee of Slavists  
[address] Gabriel Narutowicz Street No 79 apt 18, 90-138 Lodz

Franciszek SLAWSKI, born 13 May 1916  
corresponding member 1969, regular member 1980  
South Slavic linguistics  
full professor, Dr of Philosophy  
foreign member of: Austrian Academy of Sciences, Bulgarian Academy of Sciences  
director, Slavic Studies Institute, UJ Krakow, Adam Mickiewicz Blvd No 9/11, 31-120 Krakow, telephone 33-63-77 extension 309  
[address] Jan Kochanowski Street No 11 apt 13, 31-127 Krakow

Wiktor STEFFEN, born 27 September 1903  
corresponding member 1967, regular member 1976  
classical studies  
retired full professor, Adam Mickiewicz Univ in Poznan, Dr of Philosophy  
Dr h.c.: Univ of Wroclaw  
honorary member of: Polish Philological Society  
[address] Wieslawa Street No 13, 61-053 Poznan

Bogdan SUCHODOLSKI, born 27 December 1903  
corresponding member 1952, regular member 1964; member, PAN Presidium 1969-1980, deputy scientific secretary, PAN 1966-1968  
general pedagogy  
retired full professor, Warsaw University and PAN Institute of History, Science and Education, Dr of Philosophy  
Dr h.c.: Slask Univ, Katowice  
foreign member of: Academy of the History of Learning, Paris  
honorary member of: European Society of Comparative Pedagogy, International (World) Society of Pedagogical Sciences  
European Society of Comparative Pedagogy (CESE), vice president 1964-1971; International (World) Society of Pedagogical Sciences (AISE), president 1969-1973 and organizer of AISE Congress in Warsaw 1969; International Academy

of History of Learning (AIHS), vice president 1968-1971; World Federation for Futurist Studies (WFSF), vice president 1977--  
state award: individual; second degree 1964  
[address] Smiala Street No 63a, 01-526 Warsaw

Jerzy SZABLOWSKI, born 30 January 1906  
corresponding member 1967, regular member 1980  
history of art  
full professor, Dr of Art History  
honorary member of: Art Historians Association, Society for the Care of Historic Monuments  
state awards: group; second degree 1955, individual; first degree 1964  
director, Wawel State Art Collections, Krakow, telephone 22-19-50  
[address] Wladyslaw Syrokomla Street No 19a apt 4, 30-102 Krakow

Jan SZCZEPANSKI, born 14 September 1913  
corresponding member 1964, regular member 1969; member PAN Presidium 1969-1980, vice president, PAN 1972-1980  
sociology  
full professor, Dr of Philosophy  
Dr h.c.: Univ of Brno, Univ of Lodz, Sorbonne Univ, Paris, Warsaw University  
foreign member of: American Academy of Exact and Humanistic Sciences (honorary), Finnish Academy of Science and Literature, National Academy of Pedagogy, United States  
honorary member of: Czechoslovakian Sociological Society, Soviet Sociological Society  
International Sociological Association (AIS), president 1966-1970  
state award: individual; first degree 1974  
PAN Institute of Philosophy and Sociology, Nowy Swiat Street No 72, 00-330 Warsaw, telephone 26-71-81  
chairman, PRL [Polish People's Republic] Sejm Scioeconomic Council  
[address] Mokotowska Street No 46a apt 23, 00-453 Warsaw

Waclaw SZUBERT, born 19 September 1912  
regular member 1976  
labor law, social policy  
full professor, Dr of Jurisprudence  
member of: International Academy of Comparative Law  
director, Labor Law Chair, Faculty of Law and Administration, Lodz Univ, Gabriel Narutowicz Street No 59a, 90-131 Lodz, telephone 8-85-10 extension 298  
[address] Spalska Street No 3 apt 9, 02-934 Warsaw

Jerzy TOPOLSKI, born 20 September 1928  
corresponding member 1971, regular member 1976  
economic history, historical methodology  
full professor, Dr of Humanistic Studies  
state awards: individual; second degree 1970, group; first degree 1978  
director, Institute of History, Adam Mickiewicz Univ in Poznan and director, Institute of Polish History Through the 18th Century and the Historical Methodology Laboratory, Julian Marchlewski Street No 124/126, 61-874 Poznan, telephone 5-22-03  
[address] Pawel Wlodkowic Street No 10 apt 1, 60-334 Poznan

Wladyslaw WOLTER, born 5 February 1897  
regular member 1967  
penal law  
retired full professor UJ in Krakow, Dr of Jurisprudence  
honorary president, Polish Society of Forensic Medicine and Criminology,  
Krakow branch, honorary member, Society of Law Libraries and Students, UJ  
[address] Gontyn Street No 6, apt 4, 30-203 Krakow

Stefan ZOLKIEWSKI, born 9 December 1911  
corresponding member 1952, regular member 1961; member, PAN Presidium 1952-  
1968, 1981--, secretary, Section I--Social Sciences, PAN 1952-1953, 1960-1968,  
scientific secretary, PAN 1953-1955  
literary theory  
full professor, Dr of Philological Studies  
state award: group; second degree 1951, individual; second degree 1953, 1964  
director, Institute of Knowledge on Literary Culture, PAN Institute of Literary  
Research, Nowy Swiat Street No 72, 00-330 Warsaw, telephone 26-52-31 extension  
73  
[address] Blvd of Roses No 6 apt 14, 00-556 Warsaw

#### Corresponding Members

Jan BIALOSTOCKI, born 14 August 1921  
corresponding member 1976  
general art history  
Dr h.c.: Univ of Groningen  
foreign member of: Mainz Academy of Science and Literature, San Fernando  
Academy of Fine Arts in Madrid, Bavarian Academy of Sciences, Royal Academy  
of Science, Literature and Fine Arts of Belgium, Royal Dutch Academy of the  
Arts and Sciences, Saxon Academy of Sciences  
International Committee on Art History (CIHA), vice president 1969--,  
International Council for Philosophy and Humanistic Studies (CIFS), vice  
president 1978--  
state award: individual; first degree 1978  
director, Modern Art History Institute, Warsaw University Art Institute,  
Krakowskie Przedmiescie No 26/28, 00-325 Warsaw, telephone 26-15-74  
curator, Foreign Art Gallery, National Museum in Warsaw, Jerozolimski Blvd  
No 3, 00-495 Warsaw, telephone 21-10-31 extension 91  
[address] Długa Street No 32/34 apt 7, 00-238 Warsaw

Henryk CHOLAJ, born 1 January 1927  
corresponding member 1973; member PAN Presidium 1975-1980, deputy secretary,  
Section I--Social Sciences, PAN 1972--; Palace of Culture and Science, 00-901  
Warsaw, telephone 20-33-65  
political economics  
full professor, Dr of Economics Studies  
director, Production Economics Chair, Political Economics Faculty, SGPiS,  
Niepodleglosc Blvd No 162, 02-554 Warsaw, telephone 49-12-51 extension 167  
[address] Julian Brun Street No 34 apt 53, 02-594 Warsaw

Marek FRITZHAND, born 12 October 1913  
corresponding member 1973  
ethics  
full professor, Dr of Philosophy  
head, Ethics Institute, Philosophy Institute, Warsaw University, Krakowskie  
Przedmiescie No 3, 00-047 Warsaw, telephone 26-43-88  
[address] Wyzwolenie Blvd No 2 apt 3, 00-570 Warsaw

Mieczyslaw KLIMOWICZ, born 14 December 1919  
corresponding member 1976  
history of Polish literature and theater  
full professor, Dr of Humanistic Studies  
Institute of Polish Philology, Wroclaw University named for Boleslaw Bierut,  
Nankier Place No 15, 50-140 Wroclaw, telephone 40-25-76  
[address] Lwowska Street No 75 apt 5, 53-420 Wroclaw

Antonina KLOSKOWSKA, born 7 November 1919  
corresponding member  
sociology of culture  
full professor, Dr of Philosophy  
director, Sociology of Culture Institute, Warsaw Univ, Karowa Street No 18,  
00-324 Warsaw, telephone 20-03-81 extension 720  
[address] Dzika Street No 6 apt 270, 00-172 Warsaw

Witold KULA, born 18 April 1916  
corresponding member 1979  
economic history  
full professor, Dr of Humanistic Studies  
Dr h.c.: Univ of Besancon  
International Association for Economic History (AIHE), vice president 1965-  
1968, president 1968-1970, honorary president 1970--; International Association  
of Metrological History (AIHPM), vice president 1975--  
Warsaw Univ Institute for Economic Studies, Długa Street No 44/50, 00-241  
Warsaw, telephone 31-44-06  
[address] Paryska Komuna Place No 4 apt 58, 01-626 Warsaw

Czeslaw KUPISIEWICZ, born 13 August 1924  
corresponding member 1976  
general teaching methodology  
director, Didactic Systems Workshop, Pedagogy Institute of Warsaw Univ,  
Szturmowa Street No 1, 02-678 Warsaw, telephone 43-66-50  
[address] Smiala Street No 44b, 01-526 Warsaw

Boguslaw LESNODORSKI, born 27 May 1914  
corresponding member 1973  
history of the Polish state and law  
full professor, Dr of Jurisprudence  
Dr h.c.: Univ of Toulouse  
state awards: individual; third degree 1951, group; second degree 1952  
Institute of Legal History, Warsaw Univ, Krakowskie Przedmiescie No 26/28,  
00-325 Warsaw, telephone 20-03-81 extension 399  
[address] Kredytowa Street No 8 apt 20, 00-062



Czeslaw MADAJCZYK, born 27 May 1921  
corresponding member 1979  
contemporary history  
full professor, Dr of Historical Studies  
International Committee on the History of World War II, vice president 1980--  
state award: individual; second degree 1972  
director, PAN Institute of History, Rynek Starego Miasta No 29/31, 00-272  
Warsaw, telephone 31-36-42  
[address] Nowiniarska Street No 1 apt 11, 00-235 Warsaw

Alojzy MELICH, born 7 June 1918  
corresponding member 1971; member, PAN Presidium 1975--, chairman, PAN branch  
in Katowice 1975--; Graniczna Street 32, 40-018 Katowice, telephone 57-12-39  
theory and policy of employment and wages  
full professor, Dr of Economics Studies  
Dr h.c.: Univ of Halle  
director, Institute of Political Economy, Karol Adamiecki Economics Academy  
in Katowice, Bogucicka Street No 3, 40-226 Katowice, telephone 58-68-44  
[address] Drozdow Street No 11, 40-538 Katowice-Brynów

Stefan NOWAKOWSKI, born 6 August 1912  
corresponding member 1971  
rural and urban sociology, sociology of the nation  
full professor, Dr of Sociology  
director, Rural and Urban Sociology Institute, Warsaw Univ Sociology Institute,  
Karowa Street No 18, 00-324 Warsaw, telephone 20-03-81 extension 702  
[address] Sady Zoliborskie No 5 apt 4, 01-772 Warsaw

Wincenty OKON, born 22 January 1914  
corresponding member 1973  
pedagogy, theory of education  
full professor, Dr of Philosophy  
Dr h.c.: Higher Pedagogical School, Krakow  
International Society for Research on the Socialization of Youth, president  
1977--  
director, Chair of Teaching Methodology, Pedagogical Faculty, Warsaw Univ,  
Szturmowa Street No 1, 02-678 Warsaw, telephone 47-02-73

Kazimierz OPALEK, born 13 August 1918  
corresponding member 1976  
political science, theory of the state and the law  
full professor, Dr of Legal Studies  
Dr. h.c.: Univ of Pecs  
member of: International Academy for the History of Learning  
director, Institute for State and Legal Theory, Political Science Institute,  
UJ, Stanislaw Ziaja Street No 5, 31-114 Krakow, telephone 22-50-89  
[address] Mazowiecka Street No 2 apt 3, 30-036 Krakow

Jozef PAJESTKA, born 9 March 1924  
corresponding member 1973  
socioeconomic development, economic process direction  
full professor, Dr of Economic Sciences  
director, PAN Institute for Economic Sciences, Palace of Culture and Science,  
00-901 Warsaw, telephone 20-02-11, extension 40-89  
[address] Aleksander Sulkiewicz Street No 7 apt 12, 00-758 Warsaw

Emanuel ROSTWOROWSKI, born 8 January 1923  
corresponding member, 1979; deputy scientific secretary, Krakow PAN branch  
1981--, Slawkowska Street No 17, 31-016 Krakow, telephone 22-48-53  
Polish and general 18th century history, biographistics  
full professor, Dr of Philosophy  
director, PAN Institute of History "Polish Biographical Dictionary" Institute,  
Slawkowska Street No 17, 31-016 Krakow, telephone 22-29-61  
[address] Gontyna Street No 10, 30-203 Krakow

Wieslaw SADOWSKI, born 2 January 1922  
corresponding member 1969  
econometrics  
full professor, Dr of Economic Sciences  
SGPiS Institute of Econometrics in Warsaw, telephone 49-12-51 extension 154  
president, Central Office of Statistics [GUS], Niepodleglosc Blvd No 208,  
02-555 Warsaw, telephone 25-22-15  
[address] Na Skarpie Blvd No 19 apt 3, 00-488 Warsaw

Margaret SCHLAUCH, born 25 September 1898  
corresponding member 1960  
English studies  
retired full professor, Warsaw University, Dr of Philosophy  
[address] Brzozowa Street No 10, apt 12, 00-286 Warsaw

Sylwester ZAWADZKI, born 19 October 1921  
corresponding member 1976  
constitutional law, state and legal theory  
full professor, Dr of Juridical Studies  
Dr h.c.: Univ of Wroclaw  
Warsaw University Institute for Studies on the State and the Law, Krakowskie  
Przedmiescie No 26/28, 00-325 Warsaw, telephone 20-03-81, extension 397  
minister of justice, Ujazdowski Street No 11, 00-567 Warsaw, telephone 28-73-68  
[address] Wiejska Street No 18 apt 9, 00-490 Warsaw

## Section II--Biological Sciences

### Regular Members

Tadeusz BARANOWSKI, born 13 September 1910  
corresponding member 1954, regular member 1969, member, PAN Presidium 1966--1974

physiological chemistry  
retired full professor, Medical Academy in Wroclaw, Dr of Medical Studies  
foreign member of: Leopoldin German Academy of Natural Sciences  
state awards: individual second degree 1952, group; first degree 1964  
[address] Szarotkowa Street No 6, 51-250 Wroclaw

Stefan BIALOBOK, born 11 May 1909  
regular member 1976  
genetics of arborescent plants  
retired full professor, PAN Institute of Dendrology, Dr of Exact Sciences  
International Dendrological Society (IDS), vice president 1968--  
[address] Parkowa Street No 3, 63-120 Kornik near Poznan

Irena CHMIELEWSKA, born 13 July 1905  
corresponding member 1964, regular member 1973; member, PAN Presidium 1972--1974

biochemistry  
retired full professor, Warsaw University, Dr of Chemistry  
honorary member of: Polish Biochemical Society  
state award: individual; third degree 1951  
[address] Rakowiecka Street No 22 apt 16, Blvd E, 02-517 Warsaw

Zygmunt EWY, born 27 April 1913  
corresponding member, 1969, regular member 1976  
animal physiology  
full professor, Dr of Physiology  
honorary member of: Polish Physiological Society, Polish Society of Veterinary Sciences  
director, Institute of Applied Animal Physiology, Agricultural Academy in Krakow, Adam Mickiewicz Blvd No 21, 31-120 Krakow, telephone 33-38-24  
[address] Ambrozy Grabowski Street No 5 apt 3, 31-126 Krakow

Waclaw GAJEWSKI, born 28 February 1911  
corresponding member 1958, regular member 1969; member, PAN Presidium 1981--  
genetics  
retired full professor, Warsaw University and PAN Institute of Biochemistry and Biophysics, Dr of Biological Sciences  
state awards: individual; first degree 1976  
[address] Miaczynska Street No 54 apt 58, 02-637 Warsaw

Franciszek GORSKI, born 6 August 1897  
corresponding member 1962, regular member 1969  
plant physiology  
retired full professor UJ in Krakow, Dr of Philosophy  
Dr h.c.: Agricultural Academy [AR] Krakow  
[address] Zygmunt Krasinski Blvd No 14, 30-061 Krakow

Zygmunt GRODZINSKI, born 24 April 1896  
corresponding member 1956, regular member 1961  
animal (vertebrate) morphology from ultra- to macrostructures, primarily the  
circulatory system and the vitellus  
retired full professor, UJ in Krakow, Dr of Philosophy  
Dr h.c.: Univ of Torun  
honorary member of: Polish Naturalists' Society named for Mikolaj Kopernik,  
Polish Anatomical Society, Polish Zoological Society  
state award: individual; second degree 1955  
[address] Feliks Dzierzynski Street No 9a apt 8, 30-046 Krakow

Zofia KIELAN-JAWOROWSKA, born 25 April 1925  
corresponding member 1967, regular member 1973; PAN Presidium member 1972--  
paleontology  
full professor, Dr of Biological Sciences  
honorary member of: Polish Naturalists' Society named for Mikolaj Kopernik,  
U.S. Society for Vertebrate Paleontology  
International Union for Geological Studies (IUGS), vice president 1980--;  
1980 International Geological Congress, vice president  
state award: individual; second degree 1974  
director, PAN Paleobiology Institute, Zwirka and Wigura Streets No 93, 02-089  
Warsaw, telephone 22-16-52  
[address] Bonifacy Street 141, 02-909 Warsaw

Wladyslaw KUNICKI-GOLDFINGER, born 13 February 1916  
corresponding member 1965, regular member 1980  
microbiology, genetics, theoretical biology  
full professor, Dr of Mathematical-Natural Sciences  
state award: individual; third degree 1955  
Warsaw University Institute of Microbiology, Nowy Swiat Street 67, 00-046  
Warsaw, telephone 26-89-82  
[address] Leopold Staff Street No 107, 01-884 Warsaw

Wlodzimierz MICHAJLOW, born 24 March 1905  
corresponding member 1960; regular member 1966; member, PAN Presidium 1963-1980.  
secretary, Section II--Biological Sciences, PAN 1969-1974  
parasitology  
retired full professor, PAN Parasitology Institute, Dr of Biological Sciences  
Dr h.c.: Poznan AM [Medical Academy]  
honorary member: League for the Preservation of Wildlife, Polish Naturalists'  
Society named for Mikolaj Kopernik, Czechoslovakian Parasitological Society,  
All-Soviet Society of Helminthologists of the USSR  
International Congress of Parasitology ICOPA IV, president 1974-1978  
state awards: individual; second degree 1955, 1964  
director, PAN University, Nowy Swiat Street No 72, 00-330 Warsaw, telephone  
26-52-31, extension 23  
[address] Stanislaw Noakowski [as published] Street No 14, 00-666 Warsaw

Wlodzimerz NIEMIERKO, born 27 July 1897  
corresponding member 1964, regular member 1971  
comparative animal biochemistry  
retired full professor, PAN M. Nencki Institute for Experimental Biology,  
Dr of Philosophy  
foreign member of: New York Academy of Sciences  
honorary member of: Polish Biochemical Society, Polish Physiological Society  
state award: individual; second degree 1955  
[address] Krolewska Street No 45 apt 29, 00-103 Warsaw

Jerzy PAWELKIEWICZ, born 16 October 1922  
corresponding member 1967, regular member 1976; vice president, PAN branch  
in Poznan 1981--; Seweryn Mielzynski Street No 27/29, 61-725 Poznan,  
telephone 5-06-71  
biochemistry, chemical technology  
full professor, Dr of Chemical Sciences  
state awards: individual; first degree 1974  
director, Intercollegiate Institute of Biochemistry, AR in Poznan, Wolynska  
Street No 35, 60-637 Poznan, telephone 22-45-81 extension 174  
[address] Wladyslaw Kniewski Street No 1 apt 7, 60-743 Poznan

Karol STARMACH, born 22 September 1900  
corresponding member 1969, regular member 1976  
algology, fish culture  
retired associate professor, UJ in Krakow, Dr of Philosophy  
state award: individual first degree 1972  
[address] Lobzowska Street No 45, 31-139 Krakow

Henryk SZARSKI, born 13 September 1912  
corresponding member 1965, regular member 1971; member, PAN Presidium 1981--;  
vice president, PAN branch in Krakow 1981--; Slawkowska Street NO 17, 31-016  
Krakow, telephone 22-48-53  
comparative anatomy  
full professor, Dr of Philosophy  
foreign member of: New Zealand Royal Society  
Honorary member of: American Society of Ichthyologists and Herpetologists,  
French Zoological Society  
director, Institute of Comparative Anatomy, UJ Zoology Institute, Krakow,  
M. Karas Street No 6, 30-060 Krakow, telephone 33-63-71 extension 429  
[address] Juliusz Slowacki Street No 15 apt 8, 31-159 Krakow

Andrzej SRODON, born 23 November 1908  
corresponding member 1967, regular member 1976  
paleobotanist  
retired full professor, PAN Institute of Botany, Dr of Natural Sciences  
honorary member of: Polish Botanical Society  
[address] Bohdan Zaleski Street No 4a apt 1b, 31-525 Krakow

Bernard ZABLOCKI, born 1 January 1907  
corresponding member 1965, regular member 1973  
microbiology, immunology  
retired full professor, Lodz University, Dr of Medicine  
Dr h.c.: Lodz University  
honorary member of: Polish Society of Microbiologists, Polish Immunological Society  
state award: individual; second degree 1968  
[address] Solec Street No 52 apt 3, 00-382 Warsaw

Jan ZURZYCKI, born 10 February 1925  
corresponding member 1969, regular member 1980  
physiology of plant cells, photophysiology  
full professor, Dr of Natural Sciences  
foreign member of: Leopoldin German Academy of Natural Sciences  
director, Plant Physiology Institute, Molecular Biology Institute, UJ in Krakow,  
Grodzka Street No 53, 31-001 Krakow, telephone 22-71-11, extension 298  
[address] Stanislaw Staszic Street No 4, apt 5, 31-162 Krakow

#### Corresponding Members

Romuald KLEKOWSKI, born 1 January 1924  
corresponding member 1979  
ecology, hydrobiology, ecological bioenergetics  
full professor, Dr of Natural Sciences  
director, PAN Institute of Ecology, 01-150 Dziekanow Lesny Street, telephone 34-96-66  
[address] Jaktorowska Street No 2 apt 50, 01-202 Warsaw

Jan KORNAS, born 26 April 1923  
corresponding member 1973  
taxonomy and plant geography, plant ecology, phytosociology  
full professor, Dr of Natural Sciences  
Institute of Botany, UJ in Krakow, Lubicz Street No 46, 31-512 Krakow,  
telephone 11-61-44  
[address] Lesista Street No 5, 31-463 Krakow

Kazimierz KOWALSKI, born 15 March 1925  
corresponding member 1971  
zoology  
full professor, Dr of Mathematical-Natural Sciences  
director, PAN Institute for Systematic and Experimental Zoology, Slawkowska Street No 17, 31-016 Krakow, telephone 22-64-10  
[address] Mazowiecka Street No 51 apt 38, 30-019 Krakow

Leszek KUZNICKI, born 14 September 1928  
corresponding member 1976  
cell biology, evolutionism, biological methodology and history  
associate professor, Dr of Natural Sciences  
director, Workshop for the Physiology of Cellular Motion, PAN Marcel Nencki Experimental Biology Institute, Ludwik Pasteur Street No 3, 02-093 Warsaw  
telephone 22-42-88  
[address] Przemyska Street No 11, 02-361 Warsaw

Zbigniew LORKIEWICZ, born 7 May 1923  
corresponding member 1979  
genetics of bacteria  
full professor, Dr of Veterinary Medicine  
director, Microbiology Research Center, Microbiology Institute, UMCS in Lublin,  
Akademicka Street No 19, 20-033 Lublin, telephone 3-25-30  
[address] Jozef Sowinski Street No 7 apt 28, 20-040 Lublin

Marian MICHNIEWICZ, born 5 December 1922  
corresponding member 1971  
physiology of plant growth and development  
full professor, Dr of Mathematical-Natural Sciences  
director, Plant Physiology Research Center, Biology Institute, Mikolaj Kopernik  
University in Torun, Jurij Gagarin Street No 9, 87-100 Torun, tele. 1-34-46  
[address] Stanislaw Wyspianski Street No 10 apt 1, 87-100 Torun

Wlodzimierz OSTROWSKI, born 21 October 1925  
corresponding member 1973; member, PAN Presidium 1975--, scientific secretary,  
PAN branch in Krakow 1981--; Slawkowska Street No 17, 31-016 Krakow,  
telephone 22-48-53  
biochemistry of proteins and enzymes  
full professor, Dr of Medical Sciences  
foreign member of: New York Academy of Sciences  
director, Institute of Medical Biochemistry, Medical Academy [AM] in Krakow,  
Mikolaj Kopernik Street No 7, 31-034 Krakow, telephone 22-32-72  
[address] Stefan Jaracz Street No 12 apt 6, 31-132 Krakow

Przemyslaw SZAFRANSKI, born 25 February 1925  
corresponding member 1969  
biosynthesis of proteins  
full professor, Dr of Biological Sciences  
state award: groups; first degree 1978  
director, Protein Biosynthesis Research Center, PAN Biochemistry and Biophysics  
Institute, Rakowiecka Street No 36, 02-532 Warsaw, telephone 49-04-15  
[address] Stefan Baley Street No 7 apt 8, 02-132 Warsaw

Jerzy SZWEYKOWSKI, born 11 August 1925  
corresponding member 1973  
botany and genetics of plant populations, taxonomy  
full professor, Dr of Natural Sciences  
director, Genetics Research Center, Biology Institute, Adam Mickiewicz Univ in  
Poznan, Jaroslaw Dabrowski Street No 165, 60-594 Poznan, tele. 4-48-70  
[address] Szczesna Street No 18, 60-587 Poznan

Andrzej K. TARKOWSKI, born 4 May 1933  
corresponding member 1973  
animal embryology  
full professor, Dr of Natural Sciences  
state award: individual; first degree 1980  
director, Embryology Research Center, Zoology Institute, Warsaw University,  
Krakowskie Przedmiescie Street No 26/28, 00-927 Warsaw, telephone 26-83-76  
[address] Puszczyka Street No 14 apt 27, 02-777 Warsaw

Adam URBANEK, born 15 April 1928

corresponding member 1973; member, PAN Presidium and secretary, Section II--  
Biological Sciences, PAN 1975--; Palace of Culture and Science, 00-901 Warsaw  
telephone 20-33-64

paleozoology and evolutionary biology

full professor, Dr of Geological Sciences

International Paleontological Association (IPA), chairman, Research Group  
on Graptolites 1975-1978

state award: individual; first degree 1976

director, Paleontology Research Center, Fundamental Geology Institute of  
Warsaw University, Zwirka and Wigura Streets No 93, 02-089 Warsaw tele. 22-30-51  
extension 92

[address] Julian Brun Street No 12 apt 11, 02-594 Warsaw

Kazimierz L. WIERZCHOWSKI, born 4 December 1929

corresponding member 1976

molecular biophysics--the physical-chemical bases of the functions of nucleic  
acids

full professor, Dr of Natural Sciences

honorary member of: Romanian Biophysical Society, Union of Medical Societies  
of the SRR [Soviet Socialist Republic

International Association of Photobiologists (AIP), vice president 1980-1984

director, Biophysics Research Center, PAN Institute of Biochemistry and

Biophysics, Rakowiecka Street No 36, 02-532 Warsaw, telephone 49-04-17

[address] Przyjazn Housing Complex D, No 164, 00-905 Warsaw

Lech WOJTCZAK, born 10 August 1926

corresponding member 1971

bioenergetics, biochemistry of membranes

full professor, Dr of Natural Sciences

director, Workshop for Lipids and Biological Membranes, Marcel Nencki

Experimental Biology Institute of PAN, Ludwik Pasteur Street No 3, 02-093

Warsaw, telephone 22-30-81 extension 315

[address] Grojecka Street No 81/87 apt 29, 02-094 Warsaw

Kazimierz ZARZYCKI, born 18 December 1930

corresponding member 1976

ecology, geobotany

associate professor, Dr of Natural Sciences

deputy director for academic affairs, PAN Botany Institute and director, Plant

Ecology and Geography Research Center, Lubicz Street No 46, 31-512 Krakow,  
telephone 11-61-44

[address] Pokoj Blvd No 8 apt 32, 31-548 Krakow

Kazimierz ZIELINSKI, born 13 May 1929

corresponding member 1976

neurobiology

full professor, Dr of Biological Sciences

International Organization for Brain Research (IBRO), vice president 1980--

director, Marcel Nencki Experimental Biology Institute of PAN and director,

Conditioned Defense Mechanisms Laboratory, Ludwik Pasteur Street No 3, 02-093  
Warsaw, telephone 22-28-31

[address] Mila Street apt 47, 01-033 Warsaw



### Section III--Mathematical, Physical and Chemical Sciences

#### Regular Members

Osman ACHMATOWICZ, born 16 March 1899  
corresponding member 1952, regular member 1961; member, PAN Presidium 1955-1957

organic chemistry

retired full professor, Warsaw University, Dr of Chemistry, Dr of Philosophy

Dr h.c.: Lodz Polytechnic

honorary member of: London Chemical Society

state award: individual; first degree 1964

[address] Nowowiejska Street No 24 apt 1, 00-665 Warsaw

Antoni BASINSKI, born 22 March 1905  
corresponding member 1967, regular member 1976

physical chemistry

retired full professor, Mikolaj Kopernik University in Torun, Dr of Chemical Sciences

Dr h.c.: University of Torun

honorary member of: Polish Chemical Society

[address] Adam Mickiewicz Street No 7 apt 13, 87-100 Torun

Adam BIELANSKI, born 14 December 1912  
corresponding member 1965, regular member 1973; member, PAN Presidium 1975-  
physico-chemistry of solid states and heterogeneous catalysis

full professor, Dr of Philosophy

UJ Chemistry Institute, M. Karas Street No 3, 30-060 Krakow, telephone 3-63-77

[address] Jaskolcza Street No 6, 30-105 Krakow

Marian DANYSZ, born 17 March 1909  
corresponding member 1960, regular member 1969

high-energy physics of elementary particles

retired full professor, Warsaw University

Dr h.c.: Warsaw University

foreign member of: Heidelberg Academy of Sciences

International Union of Pure and Applied Chemistry (IUPAC), vice president

1963-1969; Dubno United Institute for Nuclear Studies, vice director 1956-1959

state award: group; second degree 1955, group; first degree 1966

[address] Asfaltowa Street No 2, 02-527 Warsaw

Andrzej HRYNKIEWICZ, born 29 May 1925  
corresponding member 1969, regular member 1980  
low-energy nuclear physics and physics of solid states

full professor, Dr of Natural Sciences

Dubno United Institute for Nuclear Studies, vice director 1966-1968

director, Research Institute II of Nuclear Spectroscopy of the Nuclear Physics  
Institute, Elias Radzikowski Street No 152, 31-342 Krakow, telephone 37-02-22

[address] Wolnosc Square No 4 apt 14, 30-033 Krakow

Wilhelmina IWANOWSKA, born 2 September 1905  
corresponding member 1956, regular member 1976  
astrophysics  
retired full professor, Mikolaj Kopernik University in Torun, Dr of Exact Sciences  
Dr h.c.: Univ of Leicester, Univ of Torun, Univ of Winnipeg  
honorary member of: Scientific Society in Torun, Mikolaj Kopernik Polish Society of Naturalists, Canadian Royal Astronomical Society  
International Astronomical Union (IAU), vice president 1973-1979  
[address] Jozef I. Kraszewski Street No 20 apt 15, 87-100 Torun

Zbigniew JEDLINSKI, born 8 October 1922  
corresponding member 1971, regular member 1980  
chemistry and technology of polymers  
full professor, Dr of Chemical Sciences  
state award: group; second degree 1964, 1978  
director, Wincenty Pstrowski Institute of the Physico-Chemistry and Technology of Polymers of Slask Polytechnic in Gliwice, Kuczewski Street No 9, 44-100 Gliwice, telephone 31-45-64  
director, PAN Polymers Research Institute, Maria Sklodowska-Curie Street No 34, 41-800 Zabrze, telephone 71-60-77  
[address] Karolinka Street No 16, 44-100 Gliwice

Boguslawa JEZOWSKA-TRZEBIATOWSKA, born 19 November 1908  
corresponding member 1967, regular member 1973; member, PAN Presidium 1978-;  
president, PAN branch in Wroclaw 1978-; Podwale Street No 75, 50-449 Wroclaw, telephone 44-48-13  
inorganic and bioinorganic physico-chemistry, structural coordination chemistry, spectroscopy  
retired full professor, Boleslaw Bierut University of Wroclaw, Dr of Technical Sciences  
Dr h.c.: Slovak Higher Technical School of Bratislava, Univ of Moscow, Univ of Wroclaw, Wroclaw Polytechnic  
foreign member of: GDR Academy of Sciences  
13th International Conference on Coordination Chemistry 1970 (IUPAC, PAN), president; International Conference on Molecular Spectroscopy 1972 (PAN), president; First International Conference for the Improvement of Chemistry Teaching 1973 (UNESCO, IUPAC, PAN), president; 13th European Congress on Molecular Spectroscopy 1977 (IUPAC, EPS [expansion unavailable], PAN), president  
state awards: individual; second degree 1964, individual; first degree 1976  
director, Structural Chemistry Research Center of the Institute of Low Temperatures and Structural Studies, PAN, Cathedral Square No 1, 50-950 Wroclaw telephone 22-33-25  
[address] Bracia Gierymscy Street No 20, 51-636 Wroclaw

Wiktor KEMULA, born 6 March 1902

corresponding member 1956, regular member 1961

electrochemistry, physico-chemical methods of analytical chemistry

retired full professor, Warsaw Univ, Dr of Philosophy, Dr of Chemical Sciences

foreign member of: Leopoldin German Academy of Natural Sciences

honorary president of: Polish Chemical Society, honorary member of: American

Chemical Society, Czechoslovakian Chemical Society, Japanese Chemical Society,

Royal Chemical Society of England, GDR Chemical Society, Paris Society of

Industrial Chemistry

International Union of Pure and Applied Chemistry (IUPAC), Section on Chemical

Analysis, vice chairman 1967-1969, Analytical Chemistry Division, chairman

1969-1971

state award: individual; second degree 1955, 1972

[address] Leon Schiller Street No 8 apt 7, 00-248 Warsaw

Wlodzimierz KOLOS, born 6 September 1928

corresponding member 1969, regular member 1976; member, PAN Presidium and

secretary, Section III--Mathematical, Physical and Chemical Sciences, PAN

1981--; Palace of Culture and Science, 00-901 Warsaw, telephone 20-33-46

quantum chemistry

full professor, Dr of Physical Sciences

director, Quantum Chemistry Laboratory, Institute for Basic Chemistry Problems,

Warsaw Univ, Ludwik Pasteur Street No 1, 02-993 Warsaw, tele 22-23-09

[address] Ludwik Narbutt St No 53 apt 12, 02-529 Warsaw

Wojciech KROLIKOWSKI, born 16 July 1926

corresponding member 1969, regular member 1980

theory of elementary particles, quantum field theory

full professor, Dr of Mathematical-Physical Sciences

director, Elementary Particle Theory Research Center, Institute for Theoretical

Physics, Warsaw Univ, Hoza St No 69, 00-689 Warsaw, tele 28-30-31 ext 281

[address] Chmielna St No 116/118 apt 99, 00-801 Warsaw

Stanislaw LOJASIEWICZ, born 9 October 1926

corresponding member 1971, regular member 1980

mathematical analysis

full professor, Dr of Mathematical Sciences

state award: individual; second degree 1968

director, Real Functions Research Center, UJ Mathematics Institute, Wladyslaw

Reymont St No 4, 30-059 Krakow, tele 33-63-77 ext 584, 33-97-81

[address] Kornel Ujejski St No 6, apt 3, 30-102 Krakow

Stanislaw MALINOWSKI, born 30 June 1909

corresponding member 1971, regular member 1980

organic chemistry and technology, catalysis

retired full professor, Warsaw Polytechnic, Dr of Chemical Sciences

[address] Filtrowa St No 61 apt 3, 02-056 Warsaw

Jan MICHALSKI, born 7 June 1920  
corresponding member 1962, regular member 1969; member, PAN Presidium 1966--,  
secretary, Section II--Mathematical-Physical, Chemical and Geological-  
Geographical Sciences 1972-1977, president, PAN branch in Lodz 1978--;  
Tylna St No 1, 90-364 Lodz, tele 4-31-20  
chemistry of hetero-organic compounds  
full professor, Dr of Philosophy  
foreign member of: GDR Academy of Sciences  
state awards: group; second degree 1968, individual; first degree 1978  
director, PAN Center for Molecular and Macromolecular Studies, Tylna St No 1,  
90-364 Lodz, tele 4-16-00  
[address] Brzezna St No 6 apt 3, 90-303 Lodz

Marian MIESOWICZ, born 21 November 1907  
corresponding member 1959, regular member 1964; member, PAN Presidium 1966-  
1980, vice president PAN 1969-1977, president, PAN branch in Krakow 1969-1980  
nuclear physics  
retired full professor, Stanislaw Staszic Mining-Metallurgy Academy [AGH] in  
Krakow, Dr of Philosophy  
Dr h.c.: AGH Krakow, UJ Krakow  
state awards: group; third degree 1952, group; second degree 1955, group; first  
degree 1964, Special Award 1979  
[address] Mikolajska St No 6 apt 7, 31-027 Krakow

Jan MIKUSINSKI, born 3 April 1913  
corresponding member 1965, regular member 1971  
functional analysis, distribution theory, collision theory  
full professor, Dr of Philosophy  
Dr h.c.: Univ of Rostock  
foreign member of: Serbian Academy of Sciences and Arts  
strate award: individual; second degree 1953  
director, Generalized Functions Research Center, PAN Mathematics Institute,  
Wieczorka St No 8, 40-013 Katowice, tele 53-71-64  
[address] Jaworowa No 1, 40-650 Katowice

Wladyslaw ORLICZ, born 24 May 1903  
corresponding member 1956, regular member 1961  
functional analysis  
retired full professor, Adam Mickiewicz Univ in Poznan and PAN Mathematics  
Institute, Dr of Philosophy  
Dr h.c.: Poznan Polytechnic, Univ of York  
honorary member of: Polish Mathematical Society  
state awards: individual; second degree 1952, individual; first degree 1966  
[address] Karol Libelt St No 22 apt 4, 61-707 Poznan

Arkadiusz PIEKARA, born 12 January 1904  
corresponding member 1962, regular member 1973  
non-linear di-electric and optical phenomena  
retired full professor, Warsaw Univ, Dr of Philosophy  
foreign member of: London Institute of Physics (regular)  
honorary member of: Society of Friends of Radzymin  
state awards: individual; third degree 1955, individual; second degree 1970  
[address] Opoczynska St No 11 apt 11, 02-522 Warsaw

Stefan PIOTROWSKI, born 11 April 1910  
corresponding member 1962, regular member 1969; member, PAN Presidium 1972-1974  
astrophysics  
retired full professor, Warsaw Univ, Dr of Philosophy  
honorary member of: Polish Society of Friends of Astronomy  
state award: individual; third degree 1952  
[address] Koszykowa St No 75 apt 23, 00-662 Warsaw

Jerzy PNIEWSKI, born 1 June 1913  
corresponding member 1964, regular member 1971  
high-energy physics and physics of elementary particles, hypernucleic physics  
full professor, Dr of Physics  
Dr h.c.: Univ of Lyons I, Univ of Heidelberg  
foreign member of: Heidelberg Academy of Sciences  
honorary member of: Plock Scientific Society  
state awards: group; second degree 1955, group; first degree 1966  
High-energy Physics Research Center, Experimental Physics Institute, Warsaw  
Univ, Hoza St No 69, 00-681 Warsaw, tele 29-42-09  
[address] Koszykowa St No 75 apt 33, 00-662 Warsaw

Czeslaw RYLL-NARDZEWSKI, born 7 October 1926  
corresponding member 1967, regular member 1973  
fundamentals of mathematics and mathematical logic, probability theory  
full professor, Dr of Philosophy  
state award: individual; second degree 1966  
Mathematics Institute, Wroclaw Polytechnic,  
Stanislaw Wyspianski Wybrzeze [Coast] No 27, 50-370 Wroclaw, tele 20-25-26  
[address] Muzealny [Museum] Square No 4 apt 13, 50-035 Wroclaw

Jan RZEWUSKI, born 19 December 1916  
corresponding member 1967, regular member 1976  
field theory  
full professor, Dr of Natural Sciences  
state award: individual; second degree 1966  
director, Field Theory Research Center, Theoretical Physics Institute, Wroclaw  
Univ named for Boleslaw Bierut, Wojciech Cybulski St No 36, 50-205 Wroclaw,  
tele 22-23-63  
[address] Jozef Lewartowski St No 34, 53-211 Wroclaw

Roman SIKORSKI, born 11 July 1920  
corresponding member 1962, regular member 1969  
fundamentals of mathematics, mathematical analysis, functional analysis,  
Boolean algebra  
full professor, Dr of Mathematical-Natural Sciences  
honorary member of: Polish Mathematical Society  
state award: individual; second degree 1955  
Mathematical Analysis Research Center, Warsaw Univ Institute of Mathematics,  
Palace of Culture and Science 00-901 Warsaw, tele 20-02-11 ext 25-39  
[address] Chocimska St No 35 apt 9, 00-791 Warsaw

Leonard SOSNOWSKI, born 19 February 1911  
corresponding member 1960, regular member 1969; member, PAN Presidium and  
vice president, PAN 1981--; Palace of Culture and Science, 00-901 Warsaw,  
tele 20-45-53  
full professor, Dr of Exact Sciences  
Dr h.c.: Univ of Paris VI named for Pierre and Marie Curie  
International Union for Pure and Applied Physics (IUPAP), vice president 1972-  
1978, president 1978-1981  
state awards: individual; first degree 1972, group; first degree 1978  
director, Physics of Solid Bodies Research Center, Warsaw Univ Institute for  
Experimental Physics, Hoza St No 69, 00-681 Warsaw, tele 28-76-49  
[address] Pulawska St No 1 apt 8, 02-515 Warsaw

Bohdan STALINSKI, born 1 March 1924  
corresponding member 1969, regular member 1976; deputy scientific secretary,  
PAN branch in Wroclaw 1981--, Podwale St No 75, 50-449 Wroclaw, tele 44-48-13  
physico-chemistry of solid states  
full professor, Dr of Chemical Sciences  
director, Institute of Low Temperatures and Structural Research of PAN,  
Katedralny [Cathedral] Square No 1, 50-950 Wroclaw, tele 22-96-29  
[address] Wielka St No 28 apt 3, 53-341 Wroclaw

Michal SMIALOWSKI, born 14 December 1906  
corresponding member 1952, regular member 1961; member, PAN Presidium 1952-1974,  
secretary Section III--Mathematical-Physical, Chemical and Geological-Geographic  
Sciences 1952-1971  
physical chemistry, physical metallurgy  
retired full professor, PAN Physical Chemistry Institute  
Dr of Technical Sciences  
foreign member of: Saxon Academy of Sciences  
state award: individual; second degree 1951  
[address] Marszalkowska St No 73 apt 18, 00-676 Warsaw

Andrzej TRAUTMAN, born 4 January 1933  
corresponding member 1969, regular member 1976; member, PAN Presidium 1972--,  
vice president PAN 1978-1980  
theory of relativity and gravitation, geometric methods in physics  
full professor, Dr of Physical Sciences  
foreign member of: Czechoslovakian Academy of Sciences  
state award: individual; first degree 1976

director, Warsaw Univ Institute of Theoretical Physics, Hoza St NO 69, 00-681  
Warsaw, tele 28-30-31, ext 264, 28-33-96  
[address] Slupecka St No 4 apt 87, 02-309 Warsaw

Wlodzimierz TRZEBIATOWSKI, born 25 February 1906  
corresponding member 1952, regular member 1956; member, PAN Presidium 1963-1980, vice president PAN 1969-1971, president PAN 1972-1977, president, PAN branch in Wroclaw 1970-1971  
inorganic structural chemistry  
retired full professor, PAN Low Temperatures and Structural Research Institute, Dr of Technical Sciences  
Dr h.c.: Univ of Katowice, Univ of Warsaw, Univ of Wroclaw, Wroclaw Polytechnic  
foreign member of: Cuban Academy of Sciences (honorary), Academic of Sciences of the Mongolian People's Republic, GDR Academy of Sciences, USSR Academy of Sciences, Bulgarian Academy of Sciences, Czechoslovakian Academy of Sciences  
honorary member of: Polish Chemical Society, Polish Naturalists' Society named for Mikolaj Kopernik  
state awards: individual; second degree 1955, individual; first degree 1974, Special Award 1979  
director, International Laboratory of Strong Magnetic Fields and Low Temperatures, Prochnik St No 95, 53-529 Wroclaw, tele 61-27-21  
[address] Bracia Gierymscy St No 20, 51-636 Wroclaw

Kazimierz URBANIK, born 5 February 1930  
corresponding member 1965, regular member 1973; member, PAN Presidium 1969-1980, president, PAN branch in Wroclaw 1972-1977  
functional analysis, probability theory  
full professor, Dr of Mathematical Sciences  
foreign member of: The Hague International Statistical Institute  
state awards: individual; second degree 1964, individual; first degree 1978  
director, Institute of Mathematics and director, Probability Theory Research Center, Wroclaw Univ named for Boleslaw Bierut, Uniwersytecki Square No 1, 50-137 Wroclaw, tele 22-97-17  
[address] Franciszek Stefczyk St No 8, 51-662 Wroclaw

Tadeusz URBANSKI, born 26 October 1901  
corresponding member 1952, regular member 1956; member, PAN Presidium 1955-1965  
chemical organic technology  
retired full professor, Warsaw Polytechnic, Dr of Technical Sciences  
foreign member of: Leopoldin German Academy of Natural Sciences  
honorary member of: Polish Chemical Society  
state awards: individual; first degree 1949, 1976; individual; second degree 1952  
[address] Nowowiejska St No 22 apt 27, 00-665 Warsaw

Jozef WERLE, born 23 July 1923  
corresponding member 1965, regular member 1976  
physics of elementary particles  
full professor, Dr of Physics  
director, Research Center for Nuclear Theory and Nuclear Reactions, Warsaw  
Univ Theoretical Physics Institute, Hoza St No 69, 00-681 Warsaw tele 21-40-97  
[address] Wilcza St No 62 apt 7, 00-679 Warsaw

Maciej WIEWIORSKI, born 24 August 1918  
corresponding member 1965, regular member 1976; member, PAN Presidium 1969--,  
vice president, PAN 1981--; Palace of Culture and Science 00-901 Warsaw,  
tele 20-45-53

organic spectrochemistry and chemistry of natural products  
full professor, Dr of Mathematical-Natural Sciences  
state award: individual; first degree 1980  
director, PAN Bio-organic Chemistry Research Center, Zygmunt NOskowski St  
No 12/14, 61-704 Poznan, tele 5-85-03, 5-05-32  
[address] Grunwaldzka St No 27 apt 11, 60-783 Poznan

Jerzy WROBEL, born 29 April 1923  
corresponding member 1973, regular member 1980  
natural products and heterocyclical compounds  
director, Laboratory for the Analysis of Natural Organic Raw Materials,  
Warsaw Univ Chemistry Faculty, Ludwik Pasteur St No 1, 02-093 Warsaw,  
tele 22-97-46  
[address] Rakowiecka St No 22 apt 27, 02-521 Warsaw

#### Corresponding Members

Bogdan BARANOWSKI, born 27 October 1927  
corresponding member 1973  
chemistry of solid states, thermodynamics of irreversible processes  
full professor, Dr of Chemical Sciences  
foreign member of: Leopoldin German Academy of Natural Sciences  
International Association for Progress in Science and High-pressure Technology,  
vice president 1981--  
director, Research Center for the Physico-Chemistry of Solid States, PAN  
Physical Chemistry Institute, Kasprzak St No 44/52, 01-224 Warsaw tele 32-07-49  
[address] Stefan Zeromski St No 64 apt 30, 01-846 Warsaw

Czeslaw BESSAGA, born 26 February 1932  
corresponding member 1976  
functional analysis  
full professor, Dr of Mathematical Sciences  
state award: group; first degree 1974  
vice director, Institute of Mathematics and director, Functional Analysis  
Research Center, Warsaw Univ, Palace of Culture and Science 00-901 Warsaw  
tele 2-47-40  
[address] Miodowa St No 23 apt 27, 00-246 Warsaw

Andrzej BIALAS, born 26 July 1936  
corresponding member 1976  
theoretical physics  
full professor, Dr of Mathematical-Physical Sciences  
state award: group; second degree 1974  
director, Particle Theory Research Center, UJ Physics Institute, Wladyslaw  
Reymont St No 4, 30-059 Krakow, tele 33-52-80  
[address] Kremerowska St No 5 apt 2, 31-130 Krakow



Iwo BIALYNICKI-BIRULA, born 14 June 1933  
corresponding member 1976  
theoretical physics  
full professor, Dr of Mathematical-Physical Sciences  
director, Theoretical Physics Research Center, PAN Physics Institute,  
al. Lotnikow [Pilots' Blvd] No 32/46, 02-668 Warsaw, tele 43-70-01 ext 337,  
43-53-24  
[address] Wernyhora St No 32, 02-727 Warsaw

Bogdan BOJARSKI, born 13 May 1931  
corresponding member 1973  
differential equations, mathematical analysis  
full professor, Dr of Mathematical-Physical Sciences  
director, Differential Equations Research Center, Warsaw Univ Mathematics  
Institute, Palace of Culture and Science, 00-901 Warsaw, tele 20-47-40  
[address] Ludwik Nabelak St No 18 apt 6, 00-743 Warsaw

Zbigniew CIESIELSKI, born 1 October 1934  
corresponding member 1973  
mathematical analysis  
full professor, Dr of Mathematical Sciences  
director, Gdansk branch, PAN Mathematical Institute, Abraham St No 18, 81-825  
Sopot, tele 51-08-04  
[address] 23 Marca [23rd of March] St No 79, apt 49, 81-820 Sopot

Wieslaw CZYZ, born 2 May 1927  
corresponding member 1973  
physics of the atomic nucleus  
full professor, Dr of Physical Sciences  
state award: individual; second degree 1972  
director, Research Center IV for Theoretical Physics, Nuclear Physics Institute,  
Eliaz Radzikowski St No 152, 31-342 Krakow, tele 37-02-22 ext 272  
[address] Marian Smoluchowski St No 8 apt 30, 30-083 Krakow

Jerzy HABER, born 7 May 1930  
corresponding member 1973  
physico-chemistry of solid states, physico-chemistry of surface phenomena,  
catalysis  
full professor, Dr of Chemical Sciences  
International Committee on Catalysis (ICCC), vice president 1980-1984,  
International Union for Pure and Applied Chemistry (IUPAC), Commission on the  
Colloids of the Surface Chemistry of Catalysis, vice president 1979-1983 and  
Catalysis Subcommittee, president 1978-1983, International Committee on the  
Reactivity of Solid States (ICRS), president 1976-1984  
director, Research Center for Catalysis and Physico-chemistry of Surfaces of  
PAN, Niezapominajki St No 30-239 Krakow, tele 22-57-27  
[address] Bronislawa St No 15, 30-203 Krakow

Jerzy Janik, born 30 April 1927  
corresponding member 1973  
physics of condensed matter  
full professor, Dr of Philosophy  
director, Research Center II for Structural Studies, Nuclear Physics Institute,  
Eliaz Radzikowski St No 152, 31-342 Krakow, tele 37-02-22 ext 250  
[address] St Mark St No 8, apt 2, 31-012 Krakow

Jerzy KOŁODZIEJCZAK, born 17 June 1935  
corresponding member 1973; member PAN Presidium and deputy scientific secretary, PAN 1975-1980  
physics of semi-conductors  
full professor, Dr of Mathematical-Physical Sciences  
state award: group; first degree 1978  
PAN Physics Institute, Al Lotnikow [Pilots' Blvd] No 32/46, 02-663 Warsaw  
tele 43-68-71  
[address] Walbrzyska St No 19 apt 63, 02-739 Warsaw

Jerzy Kroh, born 28 August 1924  
corresponding member 1976  
radiation chemistry  
full professor, Dr of Chemical Sciences  
European Association for Radiation Chemistry named for Miller (MTRC), vice president 1969-1977  
rector, Lodz Polytechnic, Franciszek Zwirka St No 36, 90-924 Lodz, tele 6-55-22, ext 200, 6-85-22  
director, Interministerial Institute for Radiation Technology of Lodz Polytechnic, Walery Wroblewski St No 15, 93-590 Lodz, tele 6-55-22 ext 600  
[address] Wschodnia [East] St No 61, 90-266 Lodz

Marian KRYSZEWSKI, born 17 April 1925  
corresponding member 1976  
physico-chemistry and physics of polymers  
full professor, Dr of Chemical Sciences  
deputy director, PAN Center for Molecular and Macromolecular Studies, Tylna St No 1, 90-364 Lodz, tele 4-89-81  
[address] Jaroslaw Dabrowski Square No 3 apt 6, 90-249 Lodz

Henryk KUCZYNSKI, born 26 July 1909  
corresponding member 1969  
stereochemistry  
retired full professor, Wroclaw Polytechnic, Dr of Technical Studies  
[address] Witelon St No 9, 51-616 Wroclaw

Zygmunt LASOCKI, born 16 November 1922  
corresponding member 1973; scientific secretary, PAN branch in Lodz 1978--,  
Tylna St No 1 90-364 Lodz, tele 4-31-20  
chemistry of polymers  
full professor, Dr of Technical Sciences  
director, Teaching and Scholarly Group of the Polymers Institute of Lodz Polytechnic, Franciszek Zwirka St No 36, 90-924, Lodz tele 6-55-22 ext 261  
[address] Stanislaw Lorentz St No 4 apt 5, 91-083 Lodz

Jan LOPUSZANSKI, born 21 October 1923  
corresponding member 1976  
quantum field theory and quantum theory of elementary particles  
full professor, Dr of Physics  
director, Theoretical Physics Institute, Wroclaw Univ named for Boleslaw  
Bierut, Wojciech Cybulski St No 36, 50-205 Wroclaw tele 22-23-63  
[address] Bracia Gierymscy St No 79, 51-640 Wroclaw

Jerzy LOS, born 22 March 1920  
corresponding member 1964  
fundamentals of mathematics, algebra, mathematic economics  
full professor, Dr of Mathematical-Natural Sciences  
director, Mathematical Methods of Economics Section, PAN Institute for the  
Foundations of Information Science, Palace of Culture and Science, 00-901  
Warsaw, tele 20-02-11 ext 27-20  
[address] Wiejska St No 9 apt 121, 00-480 Warsaw

Kazimierz LUKASZEWICZ, born 26 March 1927  
corresponding member 1979  
crystallography  
full professor, Dr of Technical Sciences  
director, Crystallography Research Center, PAN Institute of Low Temperatures  
and Structural Research, Katedralny [Cathedral] Square No 1, 50-950 Wroclaw,  
tele 20-10-71  
[address] Katowicka St No 43 apt 5, 52-022 Wroclaw

Jerzy MINCZEWSKI, born 11 December 1916  
corresponding member 1973  
analytical chemistry of traces  
full professor, Dr of Chemical Sciences  
plenipotentiary of the government for atomistics affairs  
Krucza St No 36, 00-522 Warsaw, tele 28-27-22  
[address] Wilcza St No 14 apt 13, 00-532 Warsaw

Stanislaw MROWEC, born 29 July 1928  
corresponding member 1976  
physico-chemistry of solid states, metals corrosion  
full professor, Dr of Chemical Sciences  
Ninth International Symposium on the Reactivity of Solid Bodies 1980, chairman,  
Organization Committee  
director, Materials Engineering Institute, AGH named for Stanislaw Staszic,  
Adam Mickiewicz Blvd No 30, 30-059 Krakow, tele 33-81-00 ext 24-67  
[address] 18 Stycznia [18 January] St NO 66 apt 7, 30-045 Krakow

Czeslaw OLECH, born 22 May 1931  
corresponding member 1973; member, PAN Presidium 1975-1980  
ordinary differential equations, mathematical theory of optimum control  
full professor, Dr of Mathematical Sciences  
state award: individual; first degree 1976  
director, PAN Mathematics Institute, Sniadecki St NO 8, 00-950 Warsaw  
tele 29-66-92  
[address] Nowy Swiat St No 23/25 apt 1, 00-029 Warsaw

Bohdan PACZYNSKI, born 8 February 1940  
corresponding member 1976  
astrophysics  
full professor, Dr of Astronomic Sciences  
foreign member of: Leopoldin German Academy of Natural Sciences  
honorary member of: Great Britain Royal Astronomical Society  
state award: individual; first degree 1980  
director, Astrophysics Laboratory, PAN Mikolaj Kopernik Astronomical Center,  
Bartycka St No 16, 00-716 Warsaw, tele 41-00-41 ext 40  
[address] Adam Plug St No 1 apt 68, 02-047 Warsaw

Stanislaw PASYNKIEWICZ, born 29 March 1930  
corresponding member 1976  
organo-metallic chemistry  
full professor, Dr of Chemical Sciences  
Federation of European Chemical Societies, chairman, Working Group for  
Organo-Metallic Chemistry 1974--  
director, Research Team on Homogeneous Catalysis, Chemistry and Organic  
Technology Institute, Warsaw Polytechnic, Koszykowa St No 7, 00-662 Warsaw,  
tele 2-10-07 ext 971  
[address] Niepodleglosc Blvd No 151 apt 13, 02-555 Warsaw

Aleksander PELCZYNSKI, born 2 July 1932  
corresponding member 1976  
functional analysis  
full professor, Dr of Mathematical Sciences  
state award: group; first degree 1974  
director, Functional Analysis Research Center, PAN Mathematics Institute,  
Sniadecki St No 8, 00-950 Warsaw, tele 28-24-71  
[address] Filtrowa St No 63 apt 36, 02-056 Warsaw

Andrzej PLIS, born 17 March 1929  
corresponding member 1976  
differential equations  
full professor, Dr of Mathematical Sciences  
director, Differential Equations Section, PAN Mathematics Institute, Ludwik  
Solski St No 30, 31-027 Krakow, tele 22-87-06  
[address] Gabriela Zapolska St No 16a, 30-126 Krakow

Henryk RATAJCZAK, born 30 September 1932  
corresponding member 1976  
chemical physics, molecular spectroscopy  
associate professor, Dr of Mathematical-Physical Sciences  
director, Chemistry Institute and director, Research Center for Theoretical  
Chemistry and Chemical Physics, Wroclaw Univ named for Boleslaw Bierut,  
Fryderyk Joliot-Curie St No 14, 50-383 Wroclaw tele 22-23-48  
[address] Bystrzycka St No 71 apt 9, 54-215 Wroclaw

Jan RYCHLEWSKI, born 23 May 1934  
corresponding member 1973; member, PAN Presidium and secretary, Section III--  
Mathematical, Physical and Chemical Sciences, PAN 1978-1980  
mechanics, applied mathematics  
associate professor, Dr of Technical Sciences  
state award: group; second degree 1968  
director, Research Group for the Mathematical Theory of Plasticity, PAN  
Institute for the Fundamental Problems of Technology, Swietokrzyska St No 21,  
00-049 Warsaw, tele 26-12-81  
[address] Niepodleglosc Blvd No 132 apt 70, 02-554 Warsaw

Andrzej SCHINZEL, born 5 April 1937  
corresponding member 1979  
numbers theory  
full professor, Dr of Mathematical-Physical Sciences  
foreign member of: Leopoldin German Academy of Natural Sciences  
state award: individual; second degree 1974  
director, Numbers Theory Research Center, PAN Mathematics Institute, Sniadecki  
St No 8, 00-950 Warsaw, tele 28-24-71  
[address] Brzozowa St No 12 apt 24, 00-286 Warsaw

Lucjan SOBCZYK, born 4 August 1927  
corresponding member 1976  
structure of molecules and intermolecular reactions  
full professor, Dr of Chemical Sciences  
Director, Physical Chemistry Research Center, Chemistry Institute, Wroclaw  
Univ named for Boleslaw Bierut, Fryderyk Joliot-Curie St No 14, 53-383 Wroclaw  
tele 22-92-81  
[address] Marian Smoluchowski St No 52 apt 5, 50-372 Wroclaw

Ryszard SOSNOWSKI, born 5 January 1932  
corresponding member 1976; deputy secretary, Section II--Mathematical,  
Physical and Chemical Sciences, PAN 1978--; Palace of Culture and Science,  
00-901 Warsaw, tele 20-33-46  
nuclear physics  
full professor, Dr of Physical Sciences  
director, Research Center VI--High-Energy Physics, Institute for Nuclear  
Research, Hoza St No 69, 00-681 Warsaw, tele 21-28-04  
[address] Marcin Kromer St No 3 apt 1, 02-062 Warsaw

Jan STANKOWSKI, born 1 January 1934  
corresponding member 1979; deputy scientific secretary, PAN branch in Poznan  
1981--; Mielzynski St No 27/29, 61-725 Poznan, tele 5-06-71  
solid body radiospectroscopy  
full professor, Dr of Mathematical-Physical Sciences  
director, PAN Molecular Physics Institute, Marian Smoluchowski St NO 17/19,  
60-179 Poznan, tele 67-47-51  
[address] Obornicka St No 39 apt 31, 60-648 Poznan

Zdzislaw SZYMANSKI, born 2 February 1926  
corresponding member 1973  
atomic nuclear theory  
full professor, Dr of Physics  
vice director, Theoretical Physics Institute and director, Research Center  
for the Structure of the Atomic Nucleus of Warsaw Univ, Hoza St No 69, 00-681  
Warsaw, tele 28-30-31 ext 280  
[address] Wilcza St No 62 apt 27, 00-679 Warsaw

Andrzej Kajetan WROBLEWSKI, born 7 August 1933  
corresponding member 1976  
physics of elementary particles and high energies  
full professor, Dr of Physical Sciences  
Dr h.c.: Univ of Siegen (FRG)  
director, Research Center for the Physics of Elementary Particles, Warsaw  
Univ Experimental Physics Institute, Hoza St NO 69, 00-681 Warsaw, tele 28-30-31  
ext 280, 21-38-10  
[address] Julian Marchlewski St No 68 apt 64, 00-170 Warsaw

Wojciech ZIELENKIEWICZ, born 6 June 1933  
corresponding member 1976  
physico-chemistry, calorimetry and thermochemistry  
associate professor, Dr of Chemical Sciences  
foreign member of: Barcelona Royal Academy of Sciences  
director, PAN Physical Chemistry Institute and director, Calorimetry  
Research Center, Marcin Kasprzak St NO 44/52, 01-224 Warsaw, tele 32-73-43  
[address] Leon Schiller St No 8 apt 30, 00-248 Warsaw

#### Section IV--Technical Sciences

##### Regular Members

Tadeusz CHOLEWICKI, born 23 October 1907  
corresponding member 1965, regular member 1980  
theory of circuits and electrical systems  
retired full professor, Warsaw Polytechnic  
honorary member of: Polish Society of Theoretical and Applied Electro-  
technology  
[address] Polna St No 54 apt 72, 00-644 Warsaw

Janusz CIBOROWSKI, born 26 January 1918  
corresponding member 1967, regular member 1973  
chemical and process engineering  
full professor, Dr of Technical Sciences  
Dr h.c.: Leningrad Technological Institute  
state awards: individual; second degree 1953, group; second degree 1955  
director, Warsaw Polytechnic Institute for Chemical Engineering, Ludwik  
Warynski St No 1, 00-645 Warsaw, tele 25-14-40, 25-91-80  
[address] Koszykowa St No 75 apt 7, 00-662 Warsaw

Boleslaw DUBICKI, born 18 March 1906  
corresponding member 1960, regular member 1969  
electrical machinery  
retired full professor, Warsaw Polytechnic, Dr of Technical Sciences  
honorary member of: Polish Society of Theoretical and Applied Electro-  
technology, Polish Electricians Association  
[address] Zwyciezcy St No 3/5 apt 10, 03-936 Warsaw

Leszek FILIPCZYNSKI, born 23 December 1923  
corresponding member 1969, regular member 1976  
ultrasound  
full professor, Dr of Technical Sciences  
honorary member of: American Institute for Ultrasound in Medicine  
European Federation of "Ultrasound in Medicine and Biology" Societies,  
vice president 1975-1979  
state awards: group; second degree 1966, 1978  
director, Ultrasound Research Center, PAN Institute for Basic Technical  
Problems, Swietokrzyska St No 21, 00-049 Warsaw, tele 26-90-41, 26-12-81  
ext 173  
[address] Akacjowa St No 10 apt 4, 02-534 Warsaw

Wladyslaw FISZDON, born 12 June 1912  
corresponding member 1960, regular member 1969; member, PAN Presidium 1981--  
mechanics of liquids and gasses, kinetic theory of gasses, mathematical  
applications in mechanics  
full professor, Dr of Technical Sciences  
foreign member of: International Astronautics Academy, Paris  
honorary member of: Great Britain Royal Astronautics Society  
International Astronautics Federation (IFA), vice president 1965-1967  
state award: group; second degree 1955  
director, Research Center for the Mechanics of Liquids and Gasses, Mechanics  
Institute of Warsaw Univ, Palace of Culture and Science, 00-901 Warsaw,  
tele 20-47-40, 20-02-11 ext 25-62  
Research Center for the Mechanics of Liquids and Gasses, PAN Institute for  
Basic Technical Problems, Swietokrzyska St No 21, 00-049 Warsaw, tele 26-98-03  
[address] Nowowiejska St NO 24 apt 2, 00-665 Warsaw

Janusz GROSZKOWSKI, born 21 March 1898  
regular member 1952; member, Pan Presidium 1955-1980, Pan vice president  
1957-1962, Pan president 1963-1971  
radio-engineering, vacuum engineering and technology  
retired full professor, Warsaw Polytechnic, Dr of Technical Sciences  
Dr h.c.: Gdansk Polytechnic, Lodz Polytechnic, Warsaw Polytechnic  
foreign member of: Cuban Academy of Sciences (honorary), Academy of Sciences  
of the Socialist Republic of Romania, USSR Academy of Sciences, Bulgarian  
Academy of Sciences, Czechoslovakian Academy of Sciences, Hungarian Academy of  
Sciences (honorary)  
honorary member of: Polish Society for Theoretical and Applied Electro-  
technology, Polish Electricians Association, New York Institute of Engineers,  
Electricians and Electronic Engineers, Society of Electronic Engineers and  
Radio-electricians of France

International Union for Radio Sciences (URSI), vice president 1966-1972  
state awards: individual; first degree 1951, 1968, group; first degree 1955,  
Special Award 1979  
[address] Nowowiejska St No 22 apt 7, 00-665 Warsaw

Jerzy GRZYMEK, born 9 April 1908  
regular member 1973  
technology of silicates and building materials  
retired full professor, AGH named for Stanislaw Staszic in Krakow, Dr of  
Technical Sciences  
Dr h.c.: AGH Krakow  
International Association of Laboratories for the Research of Materials and  
Structures (RILEM), chairman of the Technology Commission 1956-1970  
state award: individual; first degree 1951, group; second degree 1955, group;  
first degree 1968  
[address] Adam Mickiewicz No 34/36 apt 37, 01-616 Warsaw

Janusz Lech JAKUBOWSKI, born 9 December 1905  
corresponding member 1952, regular member 1956; member, PAN Presidium 1952-  
1968  
high-voltage technology  
retired full professor, Warsaw Polytechnic, Dr of Technical Sciences  
foreign member of: Academy of Sciences, Epigraphs and Literature of Toulouse  
honorary member of: Polish Electricians Association  
head of the UNESCO "Algerie 1 et 2" projects 1967-1971  
state award: individual; second degree 1951  
[address] Iganska St No 9 apt 2, 04-087 Warsaw

Jan KACZMAREK, born 2 February 1920  
corresponding member 1965, regular member 1971; member, PAN Presidium 1969-  
1980, scientific secretary, PAN 1972-1980  
theory of metalworking, superficial layer physics  
full professor, Dr of Technical Sciences  
Dr h.c.: Karl-Marx-Stadt Polytechnic, Moscow Polytechnic (MVTU)  
foreign member of: GDR Academy of Sciences, Bulgarian Academy of Sciences,  
Royal Academy of Sciences, Literature and Fine Arts of Belgium, U.S. National  
Academy of Technical Sciences  
honorary member of: Association of Polish Engineers and Technician-Mechanics,  
Association for Progress in Industrial Mechanics (GAMI)  
International Scientific-Research College for Mechanical Technology (CIRP),  
president 1972-1975  
director, Mechanical Systems Research Center, PAN Institute for Basic  
Technical Problems, Swietokrzyska St No 21, 00-049 Warsaw tele 26-98-06  
Institute for Machine Technology, Krakow Polytechnic named for Tadeusz  
Kosciuszko, Warsaw St No 24, 31-155 Krakow, tele 33-35-55  
[address] Al. I Armii WP [First Army of the Polish Army Blvd] No 16 apt 46,  
00-582 Warsaw



Igor KISIEL born 17 November 1910  
corresponding member 1969, regular member 1976  
land growth rate and reology  
retired full professor, Wroclaw Polytechnic, Dr of Technical Sciences  
[address] Bracia Gierymscy St No 140, 51-640 Wroclaw

Roman KULIKOWSKI, born 1 March 1928  
corresponding member 1967, regular member 1976; member, PAN Presidium 1972-1977, deputy scientific secretary, PAN 1972-1974  
optimization theory, theory of large systems  
full professor, Dr of Technical Sciences  
state award: individual; second degree 1964  
director, PAN Institute for Systems Research and director, Research Center for the Theory of Large Systems, Newelska St No 6, 01-441 Warsaw, tele 36-44-14  
[address] Jan Skrzetuski St No 36a, 02-726 Warsaw

Ignacy MALECKI, born 18 November 1912  
corresponding member 1954, regular member 1958; member, PAN Presidium 1961-1971, 1975-1980, deputy scientific secretary, PAN 1961-1968  
acoustics and the study of the progress of human knowledge  
full professor, Dr of Technical Sciences  
Dr h.c.: Technical Univ of Budapest  
honorary member of: Polish Acoustics Society, Spanish Acoustics Society, Acoustics Society of Latin America, Ultrasound Society of India  
Federation of European Acoustics Societies (FASE), vice president 1978--;  
International Commission on Acoustics (ICA), president 1966-1971; International Council of Scientific Unions (ISCU), vice president 1962-1968  
state awards: individual; third degree 1952, group; second-degree 1966  
director, Institute for Basic Technical Problems, PAN, Swietokrzyska St No 21, 00-049 Warsaw, tele 26-89-11  
Institute of Radio Technology, Warsaw Polytechnic, Nowowiejska St No 15/19, 00-665 Warsaw, tele 2-10-07 ext 644  
[address] Asfaltowa St No 11 apt 12, 02-527 Warsaw

Maciej NALECZ, born 27 April 1922  
corresponding member 1967, regular member 1973; member, PAN Presidium and secretary, Section IV--Technical Studies, PAN 1972-1980, deputy scientific secretary, PAN 1981--; Palace of Culture and Science, 00-901 Warsaw, tele 26-89-51  
electrotechnology, automatics, biomedical engineering  
full professor, Dr of Technical Sciences  
foreign member of: USSR Academy of Sciences  
honorary member of: World Organization of Systems and Cybernetics  
International Council of PUGWASH, president 1974--  
state award: group; second degree 1972  
director, PAN Institute for Biocybernetics and Biomedical Engineering and director, Research Center I for Biomeasurements and Biocontrol, Krajowa Rada Narodowa St No 55, 00-818 Warsaw, tele 20-64-38  
[address] P1 Zamkowy [Zamkowa Sq] No 8 apt 2, 00-277 Warsaw

Witold NOWACKI, born 20 July 1911

corresponding member 1952, regular member 1956; member, PAN Presidium 1952--,  
secretary, Section IV--Technical Sciences, PAN 1952-1957, deputy scientific  
secretary, PAN 1957-1965, scientific secretary, PAN 1966-1968, PAN vice  
president 1969-1977, PAN president 1978-1980

mechanics of continuous media

retired full professor, Warsaw Univ, Dr of Technical Sciences

Dr h.c.: Gdansk Polytechnic, Lodz Polytechnic, Poznan Polytechnic, Stockholm  
Polytechnic, Warsaw Polytechnic, Univ of Glasgow, Univ of Grenoble, Univ of  
Liege, Warsaw Univ

foreign member: Austrian Academy of Sciences, Bulgarian Academy of Sciences,  
Czechoslovakian Academy of Sciences, Royal Society of Edinburgh

honorary member of: Gdansk Scientific Society, Polish Society for Theoretical  
and Applied Mechanics, Slovak Society for Theoretical and Applied Mechanics  
International Society for Cooperation in Mechanics and Mathematics (ISIMM),  
president 1978--

state awards: individual; second degree 1949, individual; first degree 1955,  
1964

[address] Wiejska St No 18 apt 8, 00-490 Warsaw

Bohdan PASZKOWSKI, born 28 March 1916

corresponding member 1965, regular member 1976

technical physics, electron technology, electronics

full professor

honorary member of: Polish Electricians Association

state awards: group; second degree 1968

director, Physics Institute, Warsaw Polytechnic, Koszykowa St No 75, 00-662  
Warsaw tele 29-61-24

[address] Polna St No 54 apt 47, 00-644 Warsaw

Wladyslaw PELCZEWSKI, born 12 December 1917

corresponding member 1965, regular member 1980

automatics, theory of control

full professor, Dr of Technical Sciences

director, Automatics Institute, Lodz Polytechnic, Gdansk St No 176/178, 90-924  
Lodz, tele 6-76-44

[address] Brzezna St No 12 apt 5, 90-303 Lodz

Tadeusz PELCZYNSKI, born 29 March 1906

corresponding member 1960, regular member 1969

plastics processing, research on the properties of materials

retired full professor, Warsaw Polytechnic, Dr of Technical Sciences

honorary member of: Association of Polish Engineers and Technicians-Mechanics

state award: group; second degree 1964

[address] Seweryn Goszczynski St No 18, 02-610 Warsaw

Jerzy Ignacy SKOWRONSKI, born 5 September 1901  
corresponding member 1952, regular member 1964  
high-voltage technology, electrotechnical science of materials  
retired full professor, Wroclaw Polytechnic, Dr of Technical Studies  
Dr h.c.: Wroclaw Polytechnic  
honorary member of: Polish Society for Theoretical and Applied Electro-  
technology, Polish Electricians Association, Wroclaw Scientific Society  
[address] Wybrzeze Stanislaw Wyspianskiego [Stanislaw Wyspianski Coast] No 35  
apt 4, 50-370 Wroclaw

Dionizy SMOLENSKI, born 6 October 1902  
corresponding member 1964, regular member 1969; member, PAN Presidium 1969-1980,  
PAN scientific secretary 1969-1971, PAN vice president 1972-1974  
combustion theory  
retired full professor, Warsaw Polytechnic  
Dr h.c.: Warsaw Polytechnic, Wroclaw Polytechnic  
honorary member of: Legnica Scientific Society, Plock Scientific Society,  
Association of Chemical Industry Engineers and Technicians  
state award: individual; second degree 1953  
[address] Ludwik Warynski St No 9 apt 33, 00-655 Warsaw

Adam SMOLINSKI, born 1 October 1910  
corresponding member 1962, regular member 1973  
radio-electronics  
retired full professor, Warsaw Polytechnic, Dr of Technical Sciences  
International Union for Radio Sciences (URSI), vice president 1978--;  
Polish Section of the Institute of Engineers, Electricians and Electronics  
of New York, president 1973-1979; Board of the European Microwave Conferences  
vice chairman 1975, 1976, 1978  
state award: group; second degree 1964  
[address] Polna St No 54 apt 48, 00-644 Warsaw

Bogumil STANISZEWSKI, born 18 April 1924  
corresponding member 1969, regular member 1980  
thermodynamics  
full professor, Dr of Technical Sciences  
Director, Thermal Technology Institute, Warsaw Polytechnic, Nowowiejska St  
No 25/29, 00-665 Warsaw, tele 2-10-07 ext 12-36  
[address] Mokotowska St No 17 apt 13, 00-640 Warsaw

Robert SZEWALSKI, born 16 August 1903  
corresponding member 1952, regular member 1961  
energy machinery and equipment turbine technology  
retired full professor, Gdansk Polytechnic, Dr of Technical Sciences  
Dr h.c.: Gdansk Polytechnic  
state award: individual; first degree 1980  
[address] Stefan Batory St No 19, 80-251 Gdansk-Wrzeszcz

Pawel SZULKIN, born 29 August 1911  
corresponding member 1952, regular member 1961; member, PAN Presidium and  
deputy scientific secretary, PAN 1952-1957, 1961-1962  
radiotechnology  
full professor, Dr of Physical Sciences  
foreign member of: Hungarian Academy of Sciences (honorary)  
state award: group; second degree 1951, group; first degree 1953

Witold SZYMANOWSKI, born 6 May 1908  
corresponding member 1952, regular member 1969; member, PAN Presidium and  
secretary, Section IV--Technical Sciences, PAN 1966-1971  
theory and structure of machine tools  
full professor, (retired), Warsaw Polytechnic, Dr of Technical Sciences  
state award: individual; second degree 1949  
[address] Nowowiejska St No 22 apt 2, 00-665 Warsaw

Wojciech TRUSZKOWSKI, born 10 April 1921  
corresponding member 1965, regular member 1980  
physical metallurgy  
full professor, Dr of Technical Sciences  
honorary member of: French Metallurgy Society  
director, Aleksander Krupkowski Institute for the Foundations of Metallurgy of  
PAN, Wladyslaw Reymont St No 25, 30-059 Krakow, telephone 37-45-80  
[address] Smolka St No 12b apt 5, 30-513 Krakow

Stefan WEGRZYN, born 20 May 1925  
corresponding member 1964, regular member 1973; member, PAN Presidium 1969-1971,  
1974-1980  
computer science, theory of control  
full professor, Dr of Technical Sciences, Dr of the Univ in Toulouse  
Dr h.c.: Univ of Lille, Univ of Sherbrooke  
state award: individual; second degree 1966, group; first degree 1976  
director, Computer Science Institute for Real Time of Slask Polytechnic named  
for Wincenty Pstrowski in Gliwice, Wincenty Pstrowski St No 16, 44-100 Gliwice,  
tele 31-46-73  
director, Research Center for Complex Automatic Systems, PAN, Baltycka St  
No 5, 44-100 Gliwice tele 31-70-26  
[address] Stanislaw Konarski St No 11 apt 3, 44-100 Gliwice

Jan ZACHWATOWICZ, born 4 March 1900  
corresponding member 1952, regular member 1958  
architecture and urban studies, history of architecture, preservation of  
monuments  
retired full professor, Warsaw Polytechnic, Dr of Technical Sciences  
Dr h.c.: Technical Univ, Hanover  
foreign member of: Academy of Architecture, Paris, Royal Institute of British  
Architects  
honorary member of: Association of Art Historians, Society for the Care of  
Historical Monuments, Society of Polish Urbanists, French Association of  
Architects-Preservationists, International Committee for Historical City  
Centers, president 1970-1975  
state award: group; first degree 1950  
[address] Al. Roz [Bldv of Roses] No 8 apt 7a, 00-556 Warsaw

Tadeusz ZAGAJEWSKI, born 16 December 1912  
corresponding member 1960, regular member 1976; vice president, PAN branch  
in Katowice 1981--; Graniczna St No 42, 40-018 Katowice, tele 57-12-39  
industrial electrotechnology  
full professor, Dr of Technical Sciences  
honorary member of: Polish Society for Theoretical and Applied Electrotechnology  
director, Electronics Institute, Slask Polytechnic named for Wincenty Pstrowski  
in Gliwice, Wincenty Pstrowski St No 16, 44-100 Gliwice tele 31-76-27  
[address] Juliusz Slowacki St No 26 apt 4, 44-100 Gliwice

Piotr ZAREMBA, born 10 June 1910  
corresponding member 1967, regular member 1976; vice president, PAN branch  
in Gdansk 1981--; Jaskowa Dolina St No 31, 80-252 Gdansk, tele 41-73-78  
urban studies and regional planning  
retired full professor, Szczecin Polytechnic, Dr of Technical Sciences  
[address] Stanislaw Wyspianski St No 27, 70-497 Szczecin

Stefan ZIEMBA, born 21 December 1907  
corresponding member 1962, regular member 1969  
theory of machine construction, mechanics  
retired full professor, PAN Institute for Basic Technical Problems, Dr of  
Technical Sciences  
Dr h.c.: Bratislava Polytechnic, AGH Krakow, Poznan Polytechnic  
[address] Etiuda Rewolucyjna St No 46 apt 10, 02-643 Warsaw

#### Corresponding Members

Ludwik BADIAN, born 4 August 1928  
corresponding member 1976; scientific secretary, PAN branch in Wroclaw,  
tele 44-48-13  
electrotechnology and electronics of solid bodies  
full professor, Dr of Technical Sciences  
Institute for the Foundations of Electrotechnique and Electrotechnology of  
Wroclaw Polytechnic, Grunwaldzka Square No 13, 50-372 Wroclaw, tele 22-97-25  
[address] Pl Ludwika Hirszfelda [Ludwik Hirszfeld Sq] No 6 apt 6, 53-413 Wroclaw

Marceli BARAN, born 18 August 1921  
corresponding member 1979  
power systems and equipment  
associate professor, Dr of Technical Sciences  
state award: group; third degree 1955  
director, Research Center for Boilers and Steam Generators, Mechanical-Power  
Faculty of Slask Polytechnic named for Wincenty Pstrowski in Gliwice,  
Stanislaw Konarski St No 20, 44-100 Gliwice, tele 91-72-51  
[address] Jaskolcza St No 5, 44-100 Gliwice

Zbigniew BOJARSKI, born 21 August 1921  
corresponding member 1973  
crystallography, structure of metals  
full professor, Dr of Technical Sciences  
Director, Institute of the Physics and Chemistry of Metals and director,  
Research Center for Crystallography and Structural Research of Slask Univ,  
Bankowa St No 12, 40-007 Katowice, tele 59-69-29  
[address] Drozdow St No 15b, 40-530 Katowice-Brynów

Zbigniew BRZOSKA, born 27 September 1916  
corresponding member 1969  
fundamentals of machinery construction, resistance of materials and structures  
full professor, Dr of Technical Sciences  
honorary member of: Polish Society of Theoretical and Applied Mechanics  
director, Research Center for the Resistance of Materials and Structures,  
Institute for Aviation Technology and Applied Mechanics of Warsaw Polytechnic,  
Nowowiejska St No 24, 00-665 Warsaw, tele 21-007 ext 448  
[address] Nowowiejska St No 22 apt 14, 00-665 Warsaw

Roman CIESIELSKI, born 4 November 1924  
corresponding member 1971  
theory of engineering structures, the dynamics of construction, experimental  
studies of construction  
full professor, Dr of Technical Sciences  
rector, Krakow Polytechnic named for Tadeusz Kosciuszko, Warszawska St No 24  
31-155 Krakow, tele 33-03-00 ext 201 and director of the Research Center  
for Structural Analysis and Dynamics, tele ext 488  
[address] Jozef Brodowicz St No 8 apt 5, 31-518 Krakow

Bohdan CISZEWSKI, born 23 December 1922  
corresponding member 1973; member, PAN Presidium and secretary, Section IV--  
Technical Sciences, PAN 1981--; Palace of Culture and Science, 00-901 Warsaw  
tele 20-33-03  
materials engineering  
full professor, Dr of Technical Sciences  
honorary member of: International Institute for the Metallurgy of Powders (IISS)  
Gen Jaroslaw Dabrowski Military Technical Academy, Bemowo, Warsaw, tele 36-94-46  
[address] Swietojska St No 24 apt 24, 00-202 Warsaw

Wladyslaw FINDEISEN, born 28 January 1926  
corresponding member 1971  
automatics, theory of control  
full professor, Dr of Technical Sciences  
state award: individual; second degree 1976  
rector, Warsaw Polytechnic, Pl Jednosci Robotniczej [Worker Unity Sq] No 1,  
00-661 Warsaw, tele 28-59-85  
[address] Nowowiejska St No 22 apt 23, 00-665 Warsaw

Adam GIEREK, born 17 April 1938  
corresponding member 1973  
materials engineering  
full professor, Dr of Technical Sciences  
state awards: group; first degree 1972, 1976, 1980  
director, Materials Technology Research Center, Institute for Materials  
Engineering, Slask Polytechnic named for Wincenty Pstrowski in Gliwice,  
Graniczna St No 16, 40-019 Katowice, tele 51-32-82 ext 12  
[address] Drozdow St No 11d, 40-530 Katowice-Brynów

Witold GUTKOWSKI, born 13 September 1928  
corresponding member 1976  
mechanics of engineering and machine design  
full professor, Dr of Technical Sciences  
state award: group; second degree 1974  
director, Laboratory for the Mechanics of Spatial Designs, PAN Institute for  
Basic Technical Problems, Swietokrzyska St No 21, 00-049 Warsaw, tele 26-12-81  
ext 187  
[address] Zygmunt Noskowski St No 12 apt 36, 02-746 Warsaw

Lech KOBYLINSKI, born 1 May 1923  
corresponding member 1976  
hydromechanics of ships  
full professor, Dr of Technical Sciences  
Gdansk Polytechnic Ship Institute, Wladzimierz Majakowski St No 11/12, 80-952  
Gdansk, tele 47-14-80  
[address] Piastowska St No 70d apt 6, 80-363 Gdansk-Oliwa

Jan Kroszczynski, born 30 May 1927  
corresponding member 1976  
radiotechnology, radiolocation  
full professor, Dr of Technical Sciences  
state award: group; first degree 1964, 1974  
director, Industrial Institute for Telecommunications, Warsaw, Poligonowa St  
No 30, tele 10-23-80  
[address] Ludwik Narbutt St No 56 apt 5, 02-541 Warsaw

Mieczyslaw LUBINSKI, born 6 September 1921  
corresponding member 1976  
construction design  
full professor, Dr of Technical Sciences  
director, Interministerial Institute for the Construction of Warsaw Poly-  
technic, Al. Armii Ludowej [People's Army Blvd] No 16, 00-575 Warsaw, tele  
21-59-03  
[address] Koszykowa St No 75 apt 14, 00-662 Warsaw

Leon LUKASZEWICZ, born 20 November 1923  
corresponding member 1976  
electronics, computer science  
full professor, Dr of Technical Sciences  
International Federation for Data Processing (IFIP), vice president 1964-1968  
state awards: group; second degree 1955, 1964  
director, Programming Methods Section, PAN Institute for the Fundamentals of  
Computer Science, Palace of Culture and Science, 00-901 Warsaw, tele 20-02-11  
ext 22-25  
[address] Marszalkowska St No 10/16 apt 56, 00-590 Warsaw

Jan MADEJSKI, born 12 May 1925  
corresponding member 1973  
thermodynamics and heat transfer  
associate professor, Dr of Technical Sciences  
director, Thermodynamics Research Center, Aviation Institute, Rzeszow Poly-  
technic named for Ignacy Lukaszewicz, Wincenty Pol St No 2, 35-021 Rzeszow  
[address] Bonifacy St No 83/85 apt 92, 02-945 Warsaw

Zdzislaw MARCINIAK, born 10 April 1918  
corresponding member 1973  
technology of the plastic working of metals  
full professor, Dr of Technical Sciences  
International Association for Deep Stamping (IDDRG), vice president 1977-1980  
state award: group; first degree 1974, 1980  
vice rector for academic affairs, Warsaw Polytechnic, Pl Jednosci Robotniczej  
No 1, 00-661 Warsaw, tele 28-00-50 and director, Plastics Working Research  
Center, Institute for Chipless Technologies, Ludwik Narbutt St No 85, 02-524  
Warsaw, tele 49-94-37  
[address] Szczesliwicka St No 15 apt 45, 02-352 Warsaw

Wlodzimierz PROSNAK, born 21 April 1925  
corresponding member 1969; deputy scientific secretary, PAN branch in Gdansk  
1981--; Jaskowa Dolina St No 31, 80-252 Gdansk, tele 41-73-78  
fluid mechanics  
full professor, Dr of Technical Sciences  
director, Numerical Fluid Mechanics Laboratory, PAN Institute of Fluid Flow  
Machinery, Gen Jozef Fiszer St No 14, 80-952 Gdansk-Wrzeszcz, tele 41-12-71  
ext 136  
[address] Helena Maruszarzowna St No 7a apt 12, Gdansk-Morena

Wladyslaw PTAK, born 17 April 1920  
corresponding member 1969  
theoretical foundations of metallurgical processes  
full professor, Dr of Technical Sciences  
state award: individual; second degree 1964  
director, Metallurgical Processes Theory Research Center, Metallurgy Institute  
for Nonferrous Metals, AGH named for Stanislaw Staszic in Krakow, Adam  
Mickiewicz Blvd No 30, 30-059 Krakow, tele 33-81-00 ext 26-83  
[address] Daniel Chodowiecki St No 5 apt 8, 30-065 Krakow

Witold ROSINSKI, born 10 February 1911  
corresponding member 1971  
electronics of semi-conductors  
full professor, Dr of Technical Sciences  
state awards: group; first degree 1955, group; second degree 1964  
Scientific-Production Center for Electronic Materials, Konstruktorska St No 6,  
02-673 Warsaw, tele 20-12-81 ext 186  
[address] Zwanowiecka St No 124 apt 6, 04-843 Warsaw



Waclaw SAKWA, born 28 September 1918  
corresponding member 1971; scientific secretary, PAN branch in Katowice  
1975--; Graniczna St No 32, 40-018 Katowice, tele 57-12-49  
cast iron founding, the solidification and crystallization of metals  
full professor, Dr of Technical Sciences  
honorary member of: Association of Polish Foundry Engineers  
International Committee of Technical Foundry Associations (CIATF), vice  
president 1973, president 1974--  
state award: group; first degree 1972  
director, Foundry Institute, Slask Polytechnic named for Wincenty Pstrowski  
in Gliwice, Towarowa St No 1, 44-100 Gliwice, tele 31-60-31  
[address] Karolinka St No 37, 44-100 Gliwice

Antoni SAWCZUK, born 16 January 1927  
corresponding member 1969  
mechanics of continuous mediums and theory of engineering design  
full professor, Dr of Technical Sciences  
Dr h.c.: National POLYTECHNICAL Institute of Grenoble  
state award: group; second degree 1968  
director, Research Center for the Mechanics of Continuous Mediums and Research  
Center for the Theory of Design, PAN Institute for Basic Technical Problems,  
Swietokrzyska St No 21, 00-049 Warsaw, tele 26-88-02  
[address] Mikolaj Kopernik St No 8/18 apt 62, 00-367 Warsaw

Jerzy SEIDLER, born 6 September 1927  
corresponding member 1969  
theory of information and control  
full professor, Dr of Technical Sciences  
state award: individual; second degree 1972  
director, Marine Systems Group, PAN Institute for the Foundations of Computer  
Science, Palace of Culture and Science, 00-901 Warsaw, tele 20-28-73  
[address] Mikolaj Gornika St No 14, 80-279 Gdansk-Wrzeszcz

Jan SZARGUT, born 9 September 1923  
corresponding member 1976  
thermal technology  
full professor, Dr of Technical Sciences  
director, Thermal Technology Institute, Slask Polytechnic named for Wincenty  
Pstrowski, Stanislaw Konarski St No 22, 44-100 Gliwice, tele 31-42-16  
[address] Karolinka St No 13, 44-100 Gliwice

Wojciech SZCZEPINSKI, born 1 January 1924  
corresponding member 1976  
theory of plasticity and experimental mechanics  
full professor, Dr of Technical Sciences  
state award: group; second degree 1968  
director, Laboratory for the Mechanics of Plastic Flow, Research Center for  
the Mechanics of Continuous Mediums, PAN Institute for Basic Technical Problems,  
Swietokrzyska St No 21, 00-049 Warsaw, tele 26-12-82 ext 205  
[address] Lisowska St No 56 apt 2, 01-820 Warsaw

Tadeusz SLIWINSKI, born 5 June 1922  
corresponding member 1976; deputy secretary, Section IV--Technical Sciences,  
PAN 1981--; Palace of Culture and Science, 00-901 Warsaw, tele 26-29-96  
electrical machinery  
full professor, Dr of Technical Sciences  
state award: group; first degree 1964, 1976  
director, Research Center for Studies in Basic Electrotechnology, Machinery  
Industry Ministry and PAN, Electrotechnology Institute, Mieczyslaw Pozaryski  
St No 28, 04-703 Warsaw, tele 12-30-11  
[address] Wladyslaw Reymont St No 17 apt 1, 05-420 Jozefow near Otwock

Alfred SWIT, born 1 December 1928  
corresponding member 1976  
electron technology, electronics of solid states  
full professor, Dr of Technical Sciences  
director, Microelectronics Research Center, Electron Technology Institute,  
Warsaw Polytechnic, Koszykowa St No 75, 00-662 Warsaw, tele 2-10-07 ext 533  
[address] Lwowska St No 7 apt 20, 00-660 Warsaw

Kazimierz WEJCHERT, born 14 March 1912  
corresponding member 1979  
architecture, urban studies  
full professor, Dr of Technical Sciences  
foreign member of: FRG German Academy of City Building and Territorial  
Planning  
state award: group; first degree 1964  
Institute for Urban Studies and Territorial Planning, Warsaw Polytechnic,  
Koszykowa St No 55, 00-659 Warsaw, tele 28-32-36  
[address] Orezna St No 45, 02-938

Jozef WIECKOWSKI, born 12 May 1928  
corresponding member 1973; member, PAN Presidium 1981, president, PAN branch  
in Gdansk 1980--; Jaskowa Dolina St No 31, 80-252 Gdansk tele 41-73-78, 41-69-12  
theoretical and applied mechanics  
full professor, Dr of Technical Sciences  
Ship Institute, Gdansk Polytechnic, Wlodzimierz Majakowski St No 11/12, 80-952  
Gdansk-Wrzeszcz, tele 47-17-93  
[address] Stanislaw Wyspianski St No 25 apt 36, 80-434 Gdansk-Wrzeszcz

Michal ZYCZKOWSKI, born 12 April 1930  
corresponding member 1973  
theory of plasticity, reology  
full professor, Dr of Technical Sciences  
dean, Faculty of Mechanics and director, Research Center for the Mechanics  
of Deformed Bodies, Krakow Polytechnic named for Tadeusz Kosciuszko, Warsaw  
St No 24, 31-155 Krakow, tele 33-03-00 ext 502  
[address] Jerzy Zulawski St No 4 apt 4, 31-145 Krakow

## Section V--Agricultural and Forestry Sciences

### Regular Members

Stefan ALEXANDROWICZ, born 20 March 1904  
corresponding member 1967, regular member 1973  
household animal husbandry  
retired full professor, Agricultural Academy [AR] in Poznan, Dr of Agricultural Sciences  
Dr h.c.: AR Szczecin  
state award: group; second degree 1964  
[address] Grunwaldzka St No 101 apt 1, 60-313 Poznan

Kazimierz BORATYNSKI, born 30 July 1906  
corresponding member 1964, regular member 1973  
agricultural chemistry  
retired full professor, AR in Wroclaw, Dr of Philosophy  
Dr h.c.: AR Poznan  
state award: group; second degree 1980  
[address] Jan Kochanowski St No 57 apt 2, 51-602 Wroclaw

Bohdan DOBRZANSKI, born 3 March 1909  
corresponding member 1960, regular member 1969; member, PAN Presidium 1966-1980, deputy scientific secretary, PAN 1969-1971, secretary, Section V--Agricultural and Forestry Sciences, PAN 1972-1977  
physics of the soil  
retired full professor, Main School for Rural Farming, AR in Warsaw  
Dr of Agricultural Sciences  
Dr h.c.: AR Lublin, UMCS Lublin  
foreign member of: GDR Academy of Agricultural Sciences, Hungarian Academy of Sciences (honorary), USSR All-Soviet Academy of Agricultural Sciences named for V. I. Lenin  
honorary member of: Lublin Scientific Society, Polish Soil Science Society, Association of Agricultural Engineers and Technologists, German Soil Science Society (FRG), USSR All-Soviet Society of Soil Experts  
state awards: group; third degree 1950, group; first degree 1974  
[address] Marszalkowska St No 84/92 apt 111, 00-514 Warsaw

Janusz HAMAN, born 29 June 1923  
corresponding member 1969, regular member 1980; member, PAN Presidium and secretary, Section V--Agricultural and Forestry Sciences, PAN 1981--; Palace of Culture and Science, 00-901 Warsaw, tele 20-33-71  
mechanization of agriculture  
full professor, Dr of Technical Sciences  
honorary member of: Association of Polish Engineers-Mechanics, Scientific Society of Organizations and Management  
[address] Orlowicz St No 6 apt 2, 00-414 Warsaw

Jan KIELANOWSKI, born 16 June 1910  
corresponding member 1960, regular member 1971  
animal nutrition  
retired full professor, PAN Institute of Animal Physiology and Nutrition,  
Dr of Agricultural Sciences  
Dr h.c.: Univ of Humboldt, Berlin, Univ of Edinburgh  
foreign member of: GDR Academy of Agricultural Sciences  
[address] Opoczynska St No 4b, 02-526 Warsaw

Jozef KOCHMAN, born 14 December 1903  
corresponding member 1954, regular member 1966  
phytopathology, mycology  
retired full professor, Main School of Rural Farming, AR in Warsaw, Dr of  
Philosophy  
[address] Rakowiecka No 8, 02-521 Warsaw

Jadwiga LEKCZYNSKA, born 30 June 1899  
corresponding member 1952, regular member 1969  
plant cultivation, plant protection  
retired full professor, Institute for Plant Cultivation and Acclimation and  
Main School of Rural Farming, Ar in Warsaw, Dr of Philosophy, Dr of Agricul-  
tural Sciences  
[address] Adam Mickiewicz St No 34/36 apt 54, 01-616 Warsaw

Anatol LISTOWSKI, born 15 October 1904  
corresponding member 1952, regular member 1961; member, PAN Presidium 1957-  
1971, secretary, Section V--Agricultural and Forestry Sciences, PAN 1958-  
1965, vice president, PAN 1966-1968  
plant cultivation  
retired full professor, Institute for Cultivation, Fertilization and Soil  
Science, Dr of Philosophy  
foreign member of: GDR Academy of Agricultural Sciences  
[address] Armia Ludowa [People's Army] St NO 8 apt 2, 31-537 Krakow

Tadeusz LITYNSKI, born 2 June 1901  
corresponding member 1969, regular member 1976  
agricultural chemistry  
retired full professor, AR in Krakow  
Dr of Philosophy  
Dr h.c.: AR in Krakow  
honorary member of: Polish Soil Science Society  
[address] Jan Sobieski St No 5 apt 6, 31-136 Krakow

Ryszard MANTEUFFEL, born 13 August 1903  
corresponding member 1965, regular member 1971, member, PAN Presidium 1972-  
1980  
economics and organization of farms  
retired full professor, Main School of Rural Farming, AR in Warsaw, Dr of  
Agricultural Sciences  
Dr h.c.: Ar Poznan, AR Lublin  
honorary member of: Scientific Society for Organization and Management,

International Association of Agricultural Economists  
International Center for Scientific Labor Organization in Agriculture (CIOSTA),  
president 1968-1970  
[address] Slupecka St No 7 apt 16, 02-309 Warsaw

Karol Henryk MANKA, born 7 January 1915  
corresponding member 1969, regular member 1980  
phytopathology, in particular the diseases of forest trees and their environmental causes  
Institute for Forest Protection, Ar in Poznan, Wojsko Polskie [Polish Army]  
St No 71c, 60-625 Poznan, tele 22-49-01 ext 19  
[address] Kujawska St No 1, 60-618 Poznan

Witold NIEWIADOMSKI, born 2 January 1911  
regular member 1973  
general field and crop cultivation, crop production  
retired full professor, Agricultural-Technical Academy in Olsztyn, Dr of  
Agricultural Sciences  
[address] Tadeusz Kosciuszko St No 99 apt 3, 10-554 Olsztyn

Marian NUNBERG, born 8 September 1896  
corresponding member 1958, regular member 1964; member, PAN Presidium 1963-1965  
forest protection  
retired full professor, Main School for Rural Farming, AR in Warsaw, Dr of  
Technical Sciences  
Dr h.c.: SGGW [Main School for Rural Farming], Warsaw  
honorary member of: Polish Entomological Society  
state award: group; third degree 1952, group; second degree 1980  
[address] Kielecka St No 46 apt 1, 02-530 Warsaw

Szczepan PIENIAZEK, born 27 December 1913  
corresponding member 1952, regular member 1964; member, PAN Presidium, 1960--  
secretary, Section V--Agricultural and Forestry Sciences, PAN 1966-1971,  
PAN vice president 1975-1980  
fruit culture  
full professor, Dr of Horticultural Sciences  
Dr h.c.: AR Krakow  
foreign member of: Bulgarian Academy of Agricultural Sciences, GDR Academy  
of Agricultural Sciences, Agricultural Academy of France (regular), V.I. Lenin  
All-Soviet Academy of Agricultural Sciences of the USSR  
honorary member of: International Society of Horticultural Sciences, Polish  
Botanical Society  
International Society of Horticultural Sciences, president, Fruit Culture  
Section 1962-1966, vice president 1966-1970, president 1970-1974; International  
Council for Scientific Unions (ICSU), chairman, Horticultural  
Section 1970--  
state awards: individual; second degree 1950, group; first degree 1978  
director, Fruit Culture Institute, Pomologiczna St No 18, 96-100 Skierniewice,  
tele 25-49  
[address] Karowa St No 18a, apt 6, 00-324 Warsaw

Tadeusz RUEBENBAUER, born 12 January 1909  
corresponding member 1962, regular member 1969  
plant genetics and cultivation  
retired full professor, AR in Krakow, Dr of Agricultural Sciences  
Dr h.c.: AR Wroclaw  
[address] Urzednicza St No 48 apt 9, 30-048 Krakow

Abdon STRYSZAK, born 30 December 1908  
corresponding member 1960, regular member 1969  
veterinary science, epizootiology  
retired full professor SGGW, AR in Warsaw, Dr of Veterinary Medicine  
Dr h.c.: Hanover Higher Veterinary School  
honorary member of: Polish Veterinary Society  
[address] Pl Konstytucji [Constitution Sq] No 6, apt 1, 00-550 Warsaw

Stanislaw TOLPA, born 3 November 1901  
corresponding member 1967, regular member 1976  
botany, peat science, especially the biology and biochemistry of peat  
retired full professor, AR in Wroclaw, Dr of Philosophy  
[address] Sudecka St No 124, 53-129 Wroclaw

Wladyslaw WEGOREK, born 16 February 1918  
corresponding member 1967, regular member 1976; member, PAN Presidium 1981--,  
president, PAN Section in Poznan 1981--; Mielzynski St No 27/29, 61-725  
Poznan, tele 5-06-71  
plant protection, entomology  
full professor, Dr of Zoological Sciences  
honorary member of: All-Soviet Entomological Society of the USSR  
state award: group; second degree 1978  
director, Plant Protection Institute, Iwan Miczurin St NO 20, 00-318 Poznan,  
tele 67-90-21  
[address] Jozef Sowinski St No 30/32 apt 6, 60-284 Poznan

#### Corresponding Members

Anatol BRZOZA, born 20 November 1917  
corresponding member 1965  
agricultural economics  
retired full professor, Agricultural Economics Institute in Warsaw  
Agricultural Affairs Committee, UN European Economic Commission, chairman  
1965-1966  
[address] Litewska St No 10 apt 10, 00-581 Warsaw

Eugeniusz DOMANSKI, born 15 November 1909  
corresponding member 1971  
animal physiology, endocrinology  
retired full professor, PAN Institute of Animal Physiology and Nutrition,  
Dr of Veterinary Medicine  
honorary member of: Polish Physiological Society, Czechoslovakian Endocrino-  
logical Society, Society of Endocrinology and Diseases of Metabolic Change  
in Clinical Medicine of the GDR  
Mikolaj Kopernik St No 8/18 apt 29, 00-367 Warsaw

Henryk DUNIEC, born 23 June 1924  
corresponding member 1976  
animal husbandry  
full professor, Dr of Agricultural-Forestry Sciences  
director, Research Center for Hog Raising, Zootechnical Institute, Sary St No 2,  
30-960, Krakow, tele 11-30-30 ext 213  
[address] Zootechnical Institute 32-083 Balice near Krakow

Zbigniew GERTYCH, born 26 October 1922  
corresponding member 1976; member, PAN Presidium and secretary, Section V--  
Agricultural and Forestry Sciences, PAN 1978-1980, first deputy scientific  
secretary, PAN 1981--; Palace of Culture and Science, 00-901 Warsaw,  
tele 20-49-10  
fruit culture, agricultural engineering, agricultural economics  
full professor, Dr of Agricultural Sciences  
Dr h.c.: GDR Academy of Agricultural Sciences  
Sejm vice marshal, PRL [Polish People's Republic]  
[address] P1 Zamkowy [Castle Sq] No 8 apt 7, 00-277 Warsaw

Wieslaw GROCHOWSKI, born 23 January 1911  
corresponding member 1971  
forestry sciences, forest by-products  
retired full professor, Forestry Research Institute, Dr of Forestry Sciences  
[address] M. Mochnacki St No 21 apt 19, 02-041 Warsaw

Tadeusz KRZYMOWSKI, born 30 July 1927  
corresponding member 1971; member, PAN Presidium 1975-1980, vice president,  
PAN branch in Gdansk 1981--; Jaskowa Dolina St No 31, 80-252 Gdansk-Wrzeszcz,  
tele 41-73-78  
animal physiology  
full professor Dr of Veterinary Sciences  
director, Animal Physiology and Biochemistry Institute, Agricultural-Technical  
Academy in Olsztyn, 10-957 Olsztyn-Kortowo block 37, tele 2-83-72  
[address] Al. Warszawska [Warsaw Blvd] No 111 apt 2, 10-701 Olsztyn

Stanislaw NAWROCKI, born 20 November 1927  
corresponding member 1973; member, PAN Presidium 1975-1980  
technology of soil cultivation and methods of fertilization of light soils  
full professor, Dr of Agricultural Sciences  
foreign member of: V.I.Lenin All-Soviet Academy of Agricultural Sciences of  
the USSR  
director, Institute for Cultivation, Fertilization and Soil Sciences, 24-100  
Pulawy, Osada Palacowa, tele 49-60  
[address] Gleboka St No 9 apt 8, 24-100 Pulawy

Tadeusz NOWACKI, born 14 October 1918  
corresponding member 1973  
agricultural mechanization  
full professor, Dr of Agricultural Engineering Sciences  
state award: individual; second degree 1952  
director, Research Center for Agricultural Mechanization, SGGW AR Institute  
for Agricultural Mechanization, Nowoursynowska St No 166, 02-766 Warsaw,  
tele 43-18-76  
[address] Hoza St No 36 apt 38, 00-516 Warsaw

Antoni RUTKOWSKI, born 13 November 1920  
corresponding member 1971  
food chemistry and technology  
full professor, Dr of Technical Sciences  
honorary member of: Hungarian Scientific Society for the Food Industry  
director, Food Technology Institute, SGGW AR, Grochowska St No 272, 03-849  
Warsaw, tele 10-35-51  
[address] Marszalkowska St No 9/15 apt 32, 00-626 Warsaw

Stanislaw STARZYCKI, born 3 June 1923  
corresponding member 1979  
genetics and plant cultivation  
full professor, Dr of Agricultural Sciences  
director, Plant Raising and Acclimation Institute and director, Radiobiology  
Research Center, Radzikow, 05-870 Blonie, tele 55-25-75  
[address] Marszalkowska St No 34/50 apt 53, 00-554 Warsaw

Marian TRUSZCZYNSKI, born 21 July 1929  
corresponding member 1976  
microbiology and epizootiology  
full professor, Dr of Veterinary Medicine  
Commission for Biological Preparations Standards (OIE) Paris, vice president  
1973--  
director, Veterinary Institute and director, Microbiology Research Center, ul.  
Partyzantow [Partisans' St] No 57, 24-100 Pulawy, tele 32-70  
[address] XX-lecia PRL [20th Anniversary of the PRL] St No 6 apt 18, 24-100  
Pulawy

Tadeusz WOJTASZEK, born 15 December 1920  
corresponding member 1976  
chemical weed-killing  
full professor, Dr of Agricultural Sciences  
Dr h.c.: AR named for Timiriazev, Moscow  
director, Institute for Fruit Production, AR named for Hugon Kollataj in Krakow,  
Al 29 listopada [29 November Blvd] NO 48, 31-425 Krakow tele 11-13-00  
[address] Urzednicza St No 56 apt 3, 30-040 Krakow

Saturnin ZAWADZKI, born 7 July 1923  
corresponding member 1979; deputy secretary, Section V--Agric. and Forestry  
Sciences, PAN 1981--; Palace of Culture and Science, 00-901 Warsaw, tele 20-33-45  
soil reclamation science  
associate professor, Dr of Agricultural Sciences  
director, Reclamation and Arable Lands Inst. branch, PKWN Al [PKWN Blvd] No 29,  
20-612 Lublin, tele 2-26-41  
[address] Al PKWN No 29 apt 5, 20-612 Lublin



## Section VI--Medical Sciences

Zygmunt ALBERT, born 30 October 1908  
corresponding member 1963, regular member 1969  
pathological anatomy and experimental oncology  
retired full professor, Medical Academy [AM] in Wroclaw, Dr of Medicine  
honorary member of: Polish Society of Anatomical Pathologists, Polish  
Society of Histochemists and Cytochemists  
state award: group; first degree 1964  
[address] Witold Wojtkiewicz St No 12, 51-639 Wroclaw

Dymitr ALEKSANDROW, born 24 August 1909  
corresponding member 1965, regular member 1976  
cardiology  
full professor, Dr of Medicine  
Dr h.c.: WAM [Military Medical Academy] Lodz  
honorary member of: American Association of Cardiologists  
chief internist of the Polish Army, Center for Postgraduate Training, WAM, ul.  
Szaserow [Szaser St] No 128, 00-909 Warsaw, tele 10-58-43  
[address] Wilcza St No 35/41 apt 18, 00-678 Warsaw

Boguslaw BOBRANSKI, born 10 May 1904  
corresponding member 1960, regular member 1969  
chemistry of medicines  
retired full professor, AM in Wroclaw, Dr of Technical Sciences  
Dr h.c.: AM Wroclaw  
foreign member of: New York Academy of Sciences  
honorary member of: Polish Chemical Society, Italian Society of Pharmaceutical  
Sciences  
state award: individual; third degree 1953  
[address] Leon Wyczolkowski St No 12, 51-639 Wroclaw

Wiktor DEGA, born 7 December 1896  
corresponding member 1962, regular member 1969; member, PAN Presidium 1963-1968  
orthopedics and traumatology, rehabilitation  
retired full professor, AM in Poznan, Dr of General Medical Sciences  
Dr h.c.: AM Krakow, AM Lodz, AM Poznan, AM Wroclaw, AWF [Physical Education  
Academy] Poznan, Univ of Halle-Wittenberg  
foreign member of: American Academy of Orthopedic Surgeons, Academy of French  
Surgeons  
honorary president of: Polish Society for Battling Crippling Diseases  
honorary member of: Polish Medical Society, Polish Orthopedic and Trauma-  
tological Society, Polish Rheumatological Society, Society of Polish Surgeons,  
Austrian Union of Orthopedists, German [GDR] Society of Orthopedic Surgeons,  
U.S. Polish Medical Association, Society of Surgeons of France, GDR Society  
of Rehabilitation, the orthopedic and traumatological societies of: Bulgaria,  
Czechoslovakia, Finland, France, Yugoslavia, FRG, Hungary, USSR, Hungarian  
Society for the Rehabilitation of the Disabled  
state awards: individual; third degree 1951, individual; first degree 1968,  
Special Award 1979  
[address] Feliks Dzierzynski St No 135/137, 61-544 Poznan

Kornel GIBINSKI, born 7 September 1915  
corresponding member 1965, regular member 1973; member, PAN Presidium 1975--  
gastroenterology  
full professor, Dr of Medicine  
Dr h.c.: AM Poznan, AM Wroclaw  
foreign member of: New York Academy of Sciences  
honorary member of: Polish Medical Society, Czechoslovakian Society of  
Gastroenterological Physicians named for Purkin, GDR Society of Gastro-  
enterology  
European Society for Gastroenterological Endoscopy, vice president 1980--  
state award: individual; second degree 1970  
director, Gastroenterology Clinic of Slask Medical Academy named for Ludwik  
Warynski, ul. Medykow [Medyk St] NO 10, 40-752 Katowice, tele 52-77-80  
[address] Aleksander Zawadzki St No 63a, 40-128 Katowice

Adam GRUCA, born 3 December 1893  
corresponding member 1954, regular member 1966  
orthopedic surgery  
retired full professor, AM in Warsaw, Dr of General Medical Sciences  
Dr h.c.: AM Warsaw  
foreign member of: Surgical Academy, Paris, American Academy of Orthopedic  
Surgeons  
honorary member of: Polish Medical Society, Society of Polish Surgeons,  
International Society of Orthopedic and Traumatological Surgeons, Society  
of Orthopedic Surgeons of Mexico, Orthopedic Society of Latin American  
Countries, the orthopedic and traumatological societies of: Bulgaria,  
Czechoslovakia, France, Yugoslavia, USSR  
International Society of Orthopedic and Traumatological Surgery (SICHOT),  
vice president 1963-1966  
state award: individual; second degree 1951  
[address] Jaroslaw Dabrowski St No 43, 02-561 Warsaw

Jozef HANO, born 2 March 1906  
corresponding member 1967, regular member 1976  
pharmacology  
retired full professor, PAN Institue of Pharmacology, Dr of Medical Sciences  
honorary member of: Polish Pharmacological Society, Polish Physiological  
Society  
[address] Slawkowska St No 9 apt 2, 31-016 Krakow

Antoni HORST, born 4 June 1915  
corresponding member 1969, regular member 1980  
general pathology, human genetics  
full professor, Dr of Medicine  
honorary member of: Poznan Society of the Friends of Science  
director of the PAN Research Center for Human Genetics, Heliodor Swiecicki  
St No 6, 60-781 Poznan, tele 20-98-87  
[address] Podhalanska St No 14, 60-615 Poznan

Wladyslaw JASINSKI, born 22 January 1916  
corresponding member 1963, regular member 1971  
nuclear medicine  
full professor, Dr of Medicine  
director, Independent Laboratory for Nuclear Medicine, Medical Center for  
Postgraduate Training, Marymoncka St No 99, 01-813 Warsaw, tele 34-12-37  
ext 25  
[address] Tamka St No 34a apt 4, 00-355 Warsaw

Tadeusz KORZYBSKI, born 4 June 1906  
regular member 1973  
biochemistry, antibiotics  
retired full professor, PAN Institute of Biochemistry and Biophysics, Dr  
of General Medical Sciences  
honorary member of: Polish Biochemical Society  
state award: group; second degree 1950, group; first degree 1968  
[address] Kielecka St No 28 apt 7, 02-530 Warsaw

Jan Karol KOSTRZEWSKI, born 2 December 1915  
corresponding member 1967, regular member 1976; member, PAN Presidium 1969--,  
secretary Section VI--Medical Sciences, PAN 1972-1980, vice president, PAN  
1981--; Palace of Culture and Science, 00-901 Warsaw, tele 20-41-68  
epidemiology  
full professor, Dr of Medicine  
Dr h.c.: WAM Lodz  
foreign member of: National Academy of Medicine of France  
honorary member of: Polish Society of Epidemiologists and Communicable  
Disease Specialists, Polish Medical Society, Polish Society of Pathologists,  
Polish Medical Association of the United States, Society of Epidemiologists and  
Infection Specialists named for Miechnik of the USSR  
International Society of Epidemiologists, president 1977-1981; World Health  
Organization (WHO), vice president 1969-1970, chairman of the Executive  
Committee 1975-1976; International Commission for Endorsing the Eradication  
of Smallpox in India, Nepal and Butan, chairman 1977,...in Ethiopia and  
Countries of the African Horn, chairman 1979; World Commission for Endorsing  
the Eradication of Smallpox Worldwide, vice chairman 1978-1979; Worldwide  
Advisory Group for Expanded Inoculation Programs, chairman 1980--  
[address] Al. Roz [Rose Blvd] No 10 apt 6, 00-556 Warsaw

Hugon KOWARZYK, born 10 December 1906  
corresponding member 1958, regular member 1969; vice president, PAN branch in  
Wroclaw 1981--; Podwale St No 75, 50-449 Wroclaw, tele 44-48-13  
general and experimental pathology  
retired full professor, Ludwik Hirszfeld Institute for Immunology and  
Experimental Therapy, Dr of General Medical Sciences  
Dr h.c.: AM Wroclaw  
foreign member of: German Academy of Natural Sciences of Leopoldin  
honorary member of: Polish Physiological Society, Czechoslovakian Medical  
Society named for Purkin, Permanent Organizing Committee of International  
Electrocardiological Congresses  
state awards: individual; third degree 1950, group; first degree 1964  
[address] Aleksander Orłowski St No 11, 51-636 Wroclaw

Tadeusz KRWAWICZ, born 15 January 1910  
corresponding member 1967, regular member 1980  
oculistics  
retired full professor, AM in Lublin, Dr of Medicine  
Dr h.c.: AM Lublin, Medical Univ, Budapest  
member of: New York International Ophthalmological Academy  
foreign member of: German Academy of Natural Sciences of Leopoldin  
honorary member of: American Institute of Barraquera, Bulgarian Oculist Society, Polish Medical Association of the United States, Association of Oculist-Surgeons (SES), Society of German Oculists (GDR), Hungarian Oculist Society, All-Soviet Scientific Society of Ophthalmologists of the USSR  
Association of Cryooculists (SC), president 1966-1970  
state award: individual; first degree 1966  
[address] Ogrodowa St No 6, 20-075 Lublin

Adam KUNICKI, born 3 July 1903  
corresponding member 1965, regular member 1973  
neurosurgery  
retired full professor, PAN Center for Experimental and Clinical Medicine,  
Dr of General Medical Sciences  
honorary member of: Association of Polish Neuropathologists, British Society of Neurosurgeons, Society of Neurosurgeons of the GDR, Society of Neurosurgeons of the United States, Society of Neurosurgeons of the USSR  
World Federation of Neurosurgical Societies, vice president 1974-1977  
[address] Wisniowa St No 59 apt 8a, 02-520 Warsaw

Wlodzimierz KURYLOWICZ, born 26 September 1910  
corresponding member 1964, regular member 1971  
microbiology  
retired full professor, State Research Center for Hygiene, Dr of Medicine  
Dr h.c.: AM Krakow, Univ of Debreczyn, Univ of Liege, Univ of Lille,  
Univ of Oslo  
foreign member of GDR Academy of Sciences, Academy of Medical Sciences of the USSR, Finnish Academy of Science and Literature, National Academy of Medicine of Brazil, National Academy of Medicine of France  
honorary member of: Polish Medical Society, Society for Radiation Research of Japan, Italian Chemotherapy Society, Society of Epidemiologists, Microbiologists and Communicable Disease Specialists of the USSR, Pharmaceutical Society and Society for Applied Microbiology of Egypt, Microbiology Society and Society for Public Health of Hungary  
International Associations of Microbiological Societies (IAMS), vice president 1978--  
state awards: group; second degree 1950, group; first degree 1968  
[address] Kielecka St No 30 apt 9, 02-530 Warsaw

Tadeusz ORLOWSKI, born 13 September 1917  
corresponding member 1964, regular member 1971; member, PAN Presidium 1969-1980, secretary, Seciton VI--Medical Sciences, PAN 1969-1971, first deputy scientific secretary, PAN 1972-1980  
nephrology, clinical transplantology, internal medicine  
full professor, Dr of Medicine  
foreign member of: Hungarian Academy of Sciences

honorary member of: Poznan Society of Friends of Science, GDR Nephrological Society  
state award: group; second degree 1968  
director, AM Transplantology Institute in Warsaw, Nowogrodzka St No 59, 02-006  
Warsaw, tele 29-42-07  
[address] Al Roz [Blvd of Roses] No 6 apt 13, 00-556 Warsaw

Ksawery ROWINSKI, born 17 November 1904  
corresponding member 1963, regular member 1969; member, PAN Presidium 1963-1974,  
secretary Section VI--Medical Sciences, PAN 1963-1968  
pediatric radiology  
retired full professor AM in Warsaw, Dr of General Medical Sciences  
Dr h.c.: AM Poznan  
foreign member of: Academy of Medical Sciences of the USSR  
honorary member of: Polish Medical Radiological Society, Polish Society for  
the History of Medicine, Polish Medical Society, European Society for  
Pediatric Radiology  
European Society for Pediatric Radiology (SERP), president 1968-1969, World  
Health Organization expert in affairs of training medical and paramedical  
cadres 1955-1975  
[address] ul. Sniadeckich [Sniadecki St] No 18 apt 5, 00-656 Warsaw

Stefan SLOPEK, born 1 December 1914  
corresponding member 1965, regular member 1973; member, PAN Presidium 1972-1980  
immunology  
full professor, Dr of Medicine  
Dr h.c.: AM Poznan, Slask AM, AM Wroclaw  
honorary member of: Polish Immunological Society, Polish Society of  
Microbiologists  
state awards: individual; second degree 1950, 1952, individual; first degree  
1970  
director, Ludwik Hirszfild Institute for Immunology and Experimental Therapy,  
PAN, Czerna St No 12, 54-113 Wroclaw, tele 67-94-24  
[address] Pl Muzealny [Museum Sq] No 5 apt 1, 50-035 Wroclaw

#### Corresponding Members

Wiktor BROSS, born 5 August 1903  
corresponding member 1971  
thorasyrgery, cardiosurgery, transplantology  
retired full professor, AM in Wroclaw, Dr of General Medical Sciences  
Dr h.c.: AM Wroclaw, Univ of Wroclaw  
foreign member of: German Academy of Natural Sciences of Leopoldin, New  
York Academy of Sciences  
honorary member of: Czestochowa Medical Society, Polish Medical Society, Polish  
Society of Pediatric Surgeons, Society of Polish Surgeons, Medical Society  
of Wroclaw, Wroclaw Scientific Society, Polish Medical Association of the  
United States, GDR Society of Surgeons  
International Society of Surgeons (SICH), national delegate 1954-1979, vice  
president of SICH congresses 1964, 1966, 1977  
state award: individual; third degree 1952  
[address] Drozdow St No 22, 40-530 Katowice-Brynow

Mieczyslaw CHORAZY, born 31 August 1925  
corresponding member 1971; member, PAN Presidium 1981--  
biochemistry and biology of tumors, molecular biology  
associate professor, Dr of Medicine  
honorary member of: Hungarian Oncological Society  
director, Research Center for the Biology of Tumors in the Gliwice branch of  
the Oncology Institute, Wybrzeze Czerwonej Armii [Red Army Coast] No 15, 44-100  
Gliwice, tele 31-10-61  
[address] Wybrzeze Czerwonej Armii No 15, 44-100 Gliwice

Kazimierz DUX, born 9 June 1915  
corresponding member 1971  
experimental oncology and endocrinology  
full professor, Dr of Medicine  
honorary member of: Polish Endocrinological Society  
European Society for Cancer Research (EACR), vice president 1973-1979  
state award: individual; third degree 1950  
director, Research Center for the Biology of Tumors, Oncology Institute,  
Wawelska St No 15, 00-973 Warsaw, tele 22-48-31 ext 292  
[address] Kanie, Nadarzynska St No 4, 05-058 Otrebusy

Ryszard GRYGLEWSKI, born 4 August 1932  
corresponding member 1979  
pharmacology  
full professor, Dr of Medicine  
director, Pharmacology Research Center, Medical Academy named for Mikolaj  
Kopernik in Krakow, Grzegorzeczka St No 16, 31-531 Krakow, tele 11-06-10  
[address] Smolensk St No 41 apt 32, 30-112 Krakow

Boguslaw HALIKOWSKI, born 1 March 1914  
corresponding member 1973  
metabolism, genetics, child neurology  
associate professor, Dr of Medicine  
honorary member of: Argentinian Pediatric Society, Pediatric Society of the  
Dominican Republic  
director, Pediatrics Institute of the Pomeranian Medical Academy named for  
Gen Karol Swierczewski, Pl Unii Lubelskiej [Union of Lublin Sq] No 1, 71-344  
Szczecin, tele 7-73-01  
[address] Zawadzki St No 59 apt 4, 71-246 Szczecin

Maria KOPEC, born 14 August 1919  
corresponding member 1976  
hematology, radiobiology  
full professor, Dr of Medicine  
honorary member of: Turkish Hematological Society  
state award: group; first degree 1976  
director, Research Center for Radiobiology and Health Protection of the  
Institute for Nuclear Research, Dorodna St No 16, 03-195 Warsaw, tele 11-07-36  
[address] Filtrowa St No 64 apt 17, 02-057

Jerzy MAJ, born 14 July 1922  
corresponding member 1979  
pharmacology  
full professor, Dr of Pharmacology  
honorary member of: Hungarian Pharmacological Society  
director, PAN Pharmacology Institute and director, Pharmacology Research  
Center, Smetna St No 12, 31-343 Krakow, tele 37-48-93  
[address] Nad Sudolem No 24 apt 10, 31-228 Krakow

Witold MICHALKIEWICZ, born 17 November 1914  
corresponding member 1969; scientific secretary, PAN branch in Poznan 1981--;  
Mielzynski St No 27/29, 61-725 Poznan, tele 5-06-71  
full professor, Dr of Medicine  
honorary member of: Polish Gynecological Society, Polish Medical Society,  
societies of gynecology of: Yugoslavia, GDR, Romania, Italy  
director, Institute of Gynecology and Obstetrics, AM in Poznan, Polna St No 33,  
60-535 Poznan, tele 4-46-51  
[address] Nowina St No 14G, 60-589 Poznan

Mirosław MOSSAKOWSKI, born 23 September 1929  
corresponding member 1973; member, PAN Presidium 1975--, secretary, Section VI--  
Medical Sciences, PAN 1981--; Palace of Culture and Science, 00-901 Warsaw  
tele 20-33-32  
neuropathology, neurology  
full professor, Dr of Medical Sciences  
foreign member of: Mexican Institute of Culture  
honorary member of: Polish Society of Pathologists, GDR Society of German  
Neuropathologists  
European Federation of Neuropathological Societies, president 1980--;  
International Society of Neuropathologists, vice president 1976-1980  
director, PAN Center for Experimental and Clinical Medicine and director,  
Neuropathology Group, Dworkowa St No 3, 00-748 Warsaw, tele 49-64-93, 49-79-82  
[address] Polna St NO 54 apt 40, 00-644 Warsaw

Jan NIELUBOWICZ, born 28 October 1915  
corresponding member 1969  
surgery  
full professor, Dr of Medicine  
Dr h.c.: AM Poznan  
foreign member of: Royal College of Surgeons of England  
honorary member of: Society of Polish Surgeons, Polish Orthopedic and  
Traumatological Society, Bulgarian Surgical Society, Polish Medical Association  
of the United States, Society for Vascular Surgery of Great Britain and Ireland,  
Society of Lombard Surgeons, Society of Surgeons of Lyon, Society of Surgeons  
of the GDR, Society of Italian Surgeons, Society of Medicine and Natural  
Sciences of Parma, All-Soviet Society of Surgeons of the USSR  
European Society of Cardiac and Vascular Surgeons, vice president 1971-1976,  
president 1976-1980; International Society of Surgery, vice president, Executive  
Committee 1972-1976  
state award: group; second degree 1964, 1968  
rector, AM in Warsaw, Filtrowa St No 30, 00-611 Warsaw, tele 25-19-04 and  
director, Institute of Surgery, Banach St NO 1a, 02-097 Warsaw, tele 23-02-91  
[address] Francuska St No 49 apt 46, 03-905 Warsaw

Maksym NIKONOROW, born 19 August 1913  
corresponding member 1969  
food analysis and toxicology, hygiene  
full professor, Dr of Pharmacology  
director, Research Center for the Study of Food and Items for Consumption, State Hygiene Research Center, Chocimska St No 24, 00-791 Warsaw, tele 49-74-36  
[address] Marszalkowska St No 28 apt 168, 00-576 Warsaw

Adam NOWOSLAWSKI, born 30 April 1925  
corresponding member 1976; deputy secretary Section VI--Medical Sciences, PAN 1981--; Palace of Culture and Science 00-901 Warsaw, tele 20-38-03  
pathological anatomy  
full professor, Dr of Medicine  
state award: group; second degree 1966  
director, Research Center for Immunopathology, State Hygiene Research Center, Chocimska St NO 24, 00-791 Warsaw, tele 49-31-86  
[address] A. Cieszkowski St No 3 apt 9, 01-636 Warsaw

Kazimierz OSTROWSKI, born 24 October 1921  
corresponding member 1976;  
histology  
full professor, Dr of Medicine  
honorary member of: Society for Electron Microscopy and Topochemistry of the GDR, Hungarian Anatomical Society  
director, Institute of Biostructure, AM in Warsaw and director, Histology and Embrology Research Center, Chalubinski St No 5, 02-004 Warsaw, tele 29-52-82  
[address] Marszalkowska St No 28 apt 80, 00-576 Warsaw

Witold RUDOWSKI, born 17 August 1918  
corresponding member 1973; deputy secretary Section VI--Medical Sciences PAN 1975--; Palace of Culture and Science, 00-901 Warsaw, tele 20-91-11  
general surgery and oncological surgery, transfusiology  
full professor, Dr of Medicine  
Dr h.c.: AM Poznan, AM Warsaw  
foreign member of: Academy of Surgeons of Paris, American College of Surgeons, Royal Colleges of Surgeons of England, Australia, Edinburgh, Ireland, Canada  
honorary member of: Polish Medical Society, Society of Polish Surgeons, Society of Hematologists and Transfusiologists of Poland, Hungary and Bulgaria, Association of Surgeons of India  
International Federation of Surgeons Associations, president 1975-1978  
state award: group; second degree 1972, 1978  
director, Institute of Hematology, Chocimska St No 5, 00-957 Warsaw, tele 49-85-06  
[address] Armia Ludowa St No 17 apt 1, 00-632 Warsaw



## Section VII--Earth Sciences and Mining Sciences

### Regular Members

Andrzej BOLEWSKI, born 17 July 1906  
corresponding member 1952, regular member 1976  
mineralogy and petrography, mineral raw materials  
retired full professor, Stanislaw Staszic Mining-Metallurgy Academy [AGH] in  
Krakow, Dr of Technical Sciences  
honorary member of: Polish Mineralogical Society  
[address] Radwanski St No 5, 30-073 Krakow

Edward CZETWERTYNSKI, born 28 June 1901  
corresponding member 1952, regular member 1980  
hydraulics, hydrology  
retired full professor, Warsaw Polytechnic, Dr of Technical Sciences  
[address] Wladimir Komarow St No 88 apt 83 bl. B, 02-507 Warsaw

Kazimierz DZIEWONSKI, born 10 July 1910  
regular member 1976  
geography of fruit culture, urban studies, regional planning  
retired full professor, Institute of Geography and Territorial Management,  
PAN, Dr of Technical Sciences  
honorary member of: Society of Polish City Planners  
International Association for Regional Research (IRSA), vice chairman 1971-1973  
[address] Al. Niepodleglosci [Niepodleglosc Blvd] No 156 apt 3, 02-554 Warsaw

Rajmund GALON, born 14 August 1906  
corresponding member 1969, regular member 1980  
physical geography, geomorphology  
retired full professor, Mikolaj Kopernik Univ in Torun, Dr of Philosophy  
foreign member of: German Academy of Natural Sciences of Leopoldin  
honorary member of: Polish Geographical Society, Scientific Society in Torun,  
GDR Geographical Society, Italian Geographical Society  
International Union for Quaternary Research (INQUA), vice chairman, Coastlines  
Commission (1969-1977)  
[address] Jozef I. Kraszewski St No 22 apt 20, 87-100 Torun

Zdzislaw KACZMAREK, born 7 August 1928  
corresponding member 1969, regular member 1980; member, PAN Presidium 1971-  
1974, 1978--, deputy scientific secretary, PAN 1971, secretary, Section VII--  
Earth Sciences and Mining Sciences, PAN 1978-1980, scientific secretary, PAN  
1981--; Palace of Culture and Science, 00-901 Warsaw, tele 20-33-80  
full professor, Dr of Technical Sciences  
honorary member of: Hungarian Hydrological Society  
World Meteorological Organization (WMO), vice president, Hydrology Commission  
1964-1968; International Commission for Water Supplies (IUGG), pres. 1975-1977  
PAN Geophysics Institute, 00-973 Warsaw, Ludwik Pasteur St No 3, tele 22-17-45  
[address] Al. Pierwszej Armii WP [First Army of the Polish Army Blvd] No 16  
apt 51, 00-582 Warsaw

Mieczyslaw KLIMASZEWSKI, born 26 July 1908  
corresponding member 1960, regular member 1971  
physical geography, geomorphology, geology, quaternary studies  
retired full professor, UJ, Dr of Philosophy  
Dr h.c.: Alliance College, Cambridge [Springs, Pa], Univ of Bratislava,  
Univ of Jena, Univ of Slask Katowice, Univ of Kiev, Univ of St Andrews, Univ  
of Uppsala  
foreign member of: Finnish Academy of Sciences and Literature, Yugoslavian  
Academy of Sciences and Arts, Royal Swedish Academy of Sciences, German  
Academy of Natural Sciences of Leopoldin, Saxon Academy of Sciences  
honorary member of: Polish Geographical Society, Belgian Geological Society,  
geographical societies of: Finland, Holland, Hungary, the USSR  
International Geographical Union (IGU), chairman, Subcommission for  
Geomorphological Mapmaking 1960-1968  
[address] Stanislaw Wyspianski St No 3 apt 2, 30-035 Krakow

Stanislaw LESZCZYCKI, born 8 May 1907  
corresponding member 1952, regular member 1964; member, PAN Presidium 1952-  
1968, 1978-1980, deputy scientific secretary PAN 1952-1957  
economic geography, territorial planning  
retired full professor, Warsaw Univ and PAN Institute of Geography and  
Territorial Development, Dr of Philosophy  
Dr h.c.: AE [Economics Academy] Poznan, Univ of Prague  
foreign member of: World Academy for HUmanistic and Exact Sciences, Cambridge,  
United States  
honorary member of: Polish Geogrphical Society, Polish Meteorological and  
Hydrological Society, Polish Tourist-Sightseeing Society, Society of Polish  
City Planners, geographical societies of: Austria, Czechoslovakia, France,  
Holland, Japan, Yugoslavia (Croatia, Serbia), GDR, Hungary, Italy (Florence,  
Rome), Great Britain  
International Geographical Union (IGU), vice president 1964-1968 and 1972-1976,  
president 1968-1972  
state award: group; second degree 1976  
[address] Karowa St No 18a apt 11, 00-324 Warsaw

Jerzy LITWINISZYN, born 2 August 1914  
corresponding member 1956, regular member 1966, member, PAN Presidium 1969--,  
vice president PAN 1978--; Palace of Culture and Science, 00-901 Warsaw,  
tele 20-41-68; president, PAN branch in Krakow 1981--; Slawkowska St No 17,  
31-016 Krakow, tele 22-48-53  
applied mechanics  
full professor, Dr of Technical Sciences  
Dr h.c.: AGH Krakow  
state awards: group; second degree 1953, individual; first degree 1968  
foreign member of: Mexican Academy of Engineers  
director, PAN Institute for Strata Mechanics, Wladyslaw Reymont St No 27,  
30-059 Krakow tele 7-28-82  
[address] Stefan Jaracz St No 5 apt 9, 31-143 Krakow

Edward PASSENDORFER, born 13 January 1894  
corresponding member 1960, regular member 1976  
dynamic geology, stratigraphic geology  
retired full professor, Warsaw Univ, Dr of Philosophy  
honorary member of: Polish Geological Society, Polish Society of Naturalists  
named for Mikolaj Kopernik  
state award: individual; third degree 1955  
[address] Rakowiecka St No 22a apt 22, 02-521 Warsaw

Stanislaw PAWLOWSKI, born 11 May 1910  
regular member 1976  
geology and exploratory geophysics  
retired full professor, Geological Institute in Warsaw, Dr of Technical  
Sciences  
state award: individual; first degree 1955, group; first degree 1976  
[address] Rakowiecka No 4 apt 11, 02-519 Warsaw

Wladyslaw POZARYSKI, born 4 December 1910  
corresponding member 1969, regular member 1976  
micropaleontology, techtonics, oil geology  
full professor, Dr of Geological Sciences  
foreign member of: German Academy of Natural Sciences of Leopoldin  
honorary member of: GDR Society of Geological Sciences  
state award: individual; second degree 1955; group; second degree 1964  
director, Geological Institute Laboratory, Rakowiecka St No 4, 02-519 Warsaw,  
tele 49-97-33, 49-53-51 ext 360  
[address] Marszalkowska St No 34/50 apt 2, 00-554 Warsaw

Stefan Zbigniew ROZYCKI, born 8 January 1906  
corresponding member 1952, regular member 1969  
mezozoic stratigraphy and quaternary geology  
retired full professor, Warsaw Univ, Dr of Philosophy  
state award: individual; second degree 1951, individual; first degree 1968  
[address] Krakowskie Przedmiescie No 30 apt 4, 00-325 Warsaw

Kazimierz SMULIKOWSKI, born 15 September 1900  
corresponding member 1956, regular member 1966  
petrography and mineralogy  
retired full professor, Warsaw Univ, Dr of Philosophy  
honorary member of: Polish Naturalists Society named for Mikolaj Kopernik  
state award: individual; second degree 1951, individual; first degree 1970  
[address] Konstancy I. Galczynski St No 3 apt 11, 00-362 Warsaw

Roman TEISSEYRE, born 11 April 1929  
corresponding member 1969, regular member 1980; member, PAN Presidium and  
secretary Section VII--Earth Sciences and Mining Sciences, PAN 1981--; Palace  
of Culture and Science, 00-901 Warsaw, tele 20-01-11 ext 20-95  
geophysics, seismology  
full professor, Dr of Mathematical-Physical Sciences  
foreign member of: Finnish Academy of Science and Literature  
European Seismological Commission, chairman 1976-1978  
deputy director for academic affairs, Geophysics Institute PAN, Pasteur St  
No 3, 00-973 Warsaw, tele 22-53-43

director, Research Center for the Physics of the Lithosphere, Geophysics Institute, Warsaw Univ, Pasteur St No 7, 02-093 Warsaw, tele 22-74-17  
[address] Filtrowa St No 62 apt 26, 02-057 Warsaw

#### Corresponding Members

Henryk BYSTRON, born 20 October 1920  
corresponding member 1976; deputy scientific secretary, PAN branch in Katowice, 1981--; Graniczna St No 32, 40-018 Katowice, tele 57-12-49  
mining aerology  
associate professor, Dr of Technical Sciences  
state awards: individual; third degree 1955, group; second degree 1972  
deputy director, Institute for Mine Safety. Katowice, Main Institute of Mining, ul Armii Czerwonej [Red Army St] No 83, 40-161 Katowice, tele 59-21-82  
[address] Gustaw Morcinek St No 3a apt 20, 40-124 Katowice

Czeslaw DRUET, born 29 March 1926  
corresponding member 1979; scientific secretary, PAN branch in Gdansk 1980--; Jaskowa Dolina No 31, 80-252, Gdansk-Wrzeszcz, tele 41-73-78  
hydrodynamics of free-surface water reservoirs  
full professor, Dr of Technical Sciences  
Intergovernmental Oceanographic Commission of UNESCO, vice president 1977--; International Oceanological Center of CEMA Member-Countries, chairman, Scientific-Technical Council 1976-1979  
state award: group; first degree 1976  
director, PAN Research Center for Oceanology, ul. Powstancow Warszawy [Members of Warsaw Uprising St] No 55, 81-711 Sopot, tele 51-13-49  
[address] Krolowa Jadwiga St No 7 apt 2, 81-765 Sopot

Stanislaw DZULYNSKI, born 27 August 1924  
corresponding member 1973  
geology  
full professor, Dr of Philosophy  
PAN Research Center for Geological Sciences, Senacka St No 3, 31-002 Krakow, tele 22-41-22  
[address] Winiarski St No 10 apt 18, 30-063 Krakow

Alfred JAHN, born 22 April 1915  
corresponding member 1971; member, PAN Presidium 1981--  
physical geography, geomorphology, quaternary geology  
full professor, Dr of Philosophy  
foreign member of: German Academy of Natural Sciences of Leopoldin  
honorary member of: Polish Geographic Society  
International Geographic Union (IGU), president, Commission for Research in Geomorphological Processes 1968-1976  
state award: individual; third degree 1952  
director, Geomorphology Research Center, Geographic Institute of the Univ named for Boleslaw Bierut, pl. Uniwersytecki [University Sq] No 1, 50-137 Wroclaw, tele 40-22-95  
[address] Ludwik Puget St No 24, 51-628 Wroclaw

Antoni S. KLECZKOWSKI, born 5 May 1922  
corresponding member 1979; deputy scientific secretary, PAN branch in Krakow  
1981--; Slawkowska St No 17, 31-016 Krakow, tele 22-48-53  
hydrology  
full professor, Dr of Geological Sciences  
rector, AGH in Krakow, Al. Adama Mickiewicza [Adam Mickiewicz Blvd] No 30,  
30-059 Krakow, tele 33-49-98  
director, Institute of Hydrogeology and Engineering Geology and director,  
Research Center for the Dynamics of Subterranean Waters of AGH, Al. Mickiewicza  
No 30, 30-059 Krakow, tele 33-47-62  
[address] Grunwaldzka St No 21 apt 2, 31-524 Krakow

Stanislaw KNOTHE, born 2 February 1919  
corresponding member 1976  
mining, underground exploration  
full professor, Dr of Technical Sciences  
state award: group; second degree 1953  
deputy director, Institute for Underground Mining and Work Safety, AGH, Al.  
Adama Mickiewicza No 30, 30-059 Krakow, tele 33-81-00  
[address] Daniel Chodowiecki St No 18 apt 3, 30-065 Krakow

Jerzy KOSTROWICKI, born 27 January 1918  
corresponding member 1973  
economic geography, geography of agriculture, utilization of the environment,  
territorial development  
full professor, Dr of Mathematical-Natural Sciences  
Dr h.c.: Univ of Aix-Marseille  
honorary member of: Croatian Geographic Society, Royal Geographic Society of  
Great Britain, Serbian Geographic Society, Geographic Society of Bosnia and  
Herzegovina, Geographic Society of the USSR  
International Geogrphic Union (IGU), vice president 1980--  
director, PAN Institute of Geography and Territorial Development, Krakowskie  
Przedmiescie No 30, 00-927 Warsaw, tele 26-19-31  
[address] Julian Bartoszewicz St No 1a apt 8, 00-337 Warsaw

Zygmunt KOWALCZYK, born 29 May 1908  
corresponding member 1971  
geodesy, photogrammetry, mine surveying  
retired full professor, Warsaw Polytechnic, Dr of Technical Sciences  
state award: individual; second degree 1955  
[address] Oktawia St No 1, 03-663 Warsaw

Jerzy NAWROCKI, born 20 December 1926  
corresponding member 1979  
mining, mine working  
full professor, Dr of Technical Sciences  
director, Institute for Mine Working, Slask Polytechnic named for Wincenty  
Pstrowski, Wincenty Pstrowski St NO 2, 44-102 Gliwice, tele 31-36-60  
[address] Kepowa St NO 22d, 40-583 Katowice

Roman NEY, born 18 February 1931  
corresponding member 1976  
geology of lodes, geotechnics  
full professor, Dr of Technical Sciences  
director, Energy Raw Materials Institute, AGH, Al Mickiewicza No 30, 30-059  
Krakow, tele 33-65-04  
[address] Daniel Chodowiecki St No 5 apt 13, 30-065 Krakow

Andrzej Z. SMOLARSKI, born 10 October 1927  
corresponding member 1979  
mechanics of formations, flow physics  
associate professor, Dr of Technical Sciences  
deputy director, Research Center for Flow Physics, PAN Institute for Strata  
Mechanics, W. Reymont St NO 27, 30-059 Krakow, tele 37-42-00  
[address] Julian Falat St NO 4/1 apt 14, 30-109 Krakow

Ludger SZKLARSKI, born 26 March 1912  
corresponding member 1969  
elctrotechnology of mining  
full professor, Dr of Technical Sciences  
International Committee for the Automation of Mining (ICAMC), president 1973--  
deputy director, Institute for the Automatics of Drive and Industrial  
Equipment and director, Research Center for the Automatics of Mining Equipment  
of AGH, Al Mickiewicza No 30, 30-059 Krakow, tele 33-81-00 ext 28-06  
[address] Urzednicza St No 7 apt 1, 30-051 Krakow

Jerzy ZNOSKO, born 22 January 1922  
corresponding member 1976  
stratigraphy, techtonics, exploratory geology  
associate professor, Dr of Geological Sciences  
International Program for Geological Correlation (IGCP), vice chairman of  
Project No 86  
state award: individual; third degree 1955  
Geological Institute, Rakowiecka St No 4, 02-519 Warsaw, tele 49-53-51 ext 440  
[address] Pulawska St NO 7/9 apt 27, 02-515 Warsaw

#### Foreign Members

##### Section I--Social Sciences

Claude BACKVIS (1910), foreign member 1966, Slavic Studies  
Bosveldweg 20, 1180 Brussels, Belgium

Giuliano BONFANTA (1904), foreign member 1980, linguistics  
Via S. Carini 32, Rome 00152, Italy

Vittore BRANCA (1913), foreign member 1967, history of Italian literature  
Fondazione Giorgio Cini, Isola di San Giorgio Maggiore, Venice, Italy

Fernand BRAUDEL (1902), foreign member 1962, history  
59 rue Brillant-Savarin, 75013 Paris, France

Tigran Sergeyevich XACHATUROV (1906), foreign member 1977, economics  
ul. Akademika Petrovskogo No 3 apt 30, 117 419 Moscow, USSR

Piotr Nikolayevich FEDOSEYEV (1908), foreign member 1974, philosophy  
USSR Academy of Sciences, Leninskiy Prospekt No 14, 117-901 Moscow USSR

Eugenio GARIN (1909), foreign member 1974, philosophy, history of culture  
28 via G. C. Vanini, 50129 Florence, Italy

Jean GAUDEMET (1908), foreign member 1980, history of ancient law  
14 Boulevard Jourdan, 75014 Paris, France

Ronald H. GRAVESON (1911), foreign member 1977, law  
University of London, King's College, Strand London WC 2R 2LS Great Britain

Torsten HUSEN (1916), foreign member 1977, psychology, pedagogy  
Institute of International Education, University of Stockholm  
PO Box S-10405, Stockholm 50, Sweden

Radomir LUKIC (1914), foreign member 1977, law  
Jugoslovenska Akademia Znatnosti i Umetnosti, Kucz Michaila  
25 Belgrade, Socialist Federated Republic of Yugoslavia

Manfred MAYRHOFER (1926), foreign member 1977, linguistics  
Institut fur Sprachwissenschaft der Universitat Wien, A-1010  
Vienna, Dr. Karl Lueger-Ring 1, Austria

Reinhold OLESCH (1910), foreign member 1980, Slavic studies  
D 5040 Bruhl 6, Buchenweg 9, FRG

Louis ROBERT (1904), foreign member 1970, epigraphy, ancient history  
31 Ave. Rene Coty, 75014 Paris France

Boris Aleksandrovich RYBAKOV (1908), foreign member 1970, archeology, history  
USSR Academy of Sciences, Leninskiy Prospekt No 13, 117-071, Moscow, USSR

Torgny SAVE-SODERBERGH (1914), foreign member 1980, egyptology  
Kyrkogardsgatan 27, 752 35 Uppsala, Sweden

Heinrich SCHEEL (1915), foreign member 1977, history  
Deutsche Akademie der Wissenschaften der DDR, Otto-Huschke-Str. 22/23  
108 Berlin GDR

Jean STOETZEL (1910), foreign member 1980, sociology and social psychology  
9 rue Casimir Perier, 75007 Paris France

Mixail Solomonovich STROGOVICH (1894), foreign member 1959, law  
Institute of the State and the Law, USSR Academy of Sciences, Moscow  
G-19, Frunze St No 10, USSR

Imre SZABO (1912), foreign member 1962, law  
Budapest II, Ermelleki u. 14, Hungarian People's Republic

Bazaryn SHIRENDYB (1912), foreign member 1974, history, sociology, Academy of Sciences of the Mongolian People's Republic [MRL], Ulan Bator, MRL

## Section II--Biological Sciences

Aleksandr Aleksandrovich BAYEV (1903), foreign member 1977, molecular biology USSR Academy of Sciences, Leninskiy Prospekt No 14, 117-901 Moscow, USSR

Bionizy BLASCOVIC (1913), foreign member 1977, microbiology Slovenska AKademie Vied, Mlynska Dolina No 1, 809-39 Bratislava Czechoslovakian Socialist Republic [CSSR]

Nikolay Petrovich DUBININ (1907), foreign member 1974, genetics Leninskiy Prospekt No 69, apt 366, korp. 3 Moscow, USSR

Vladimir Aleksandrovich ENGELHARDT (1894), foreign member 1974, biochemistry USSR Academy of Sciences, Leninskiy Prospekt No 14, 117-901 Moscow USSR

Severo OCHOA (1905), foreign member 1967, biochemistry New York University Medical Center, New York 550 First Ave, N.Y. 10016

Bohumir ROSICKY (1927), foreign member 1980, parasitology Ceskoslovenska Akademie Ved, Flemingovo 2, Prague 6, CRS

Dawid SHUGAR (1915), foreign member (Canada) 1980, biochemistry PAN Institute of Biochemistry and Biophysics, Rakowiecka St No 36, 02-532 Warsaw

Sergey Evgenevich SEVERIN (1901), foreign member 1970, medical and technical biochemistry Moscow University imeni Lomonosov 117-234 Moscow, USSR

Ferenc Bruno STRAUB (1914), foreign member 1967, biochemistry Magyar Tudomanyos Akademia, Szigony u. 43, 1083 Budapest, Hungarian People's Republic

Armen Leonovich TAXTADJAN (1919), foreign member 1977, botany Botanical Institute, USSR Academy of Sciences, Popova St No 2, 197 022 Leningrad, USSR

Charles Georges THIBAUT (1919), foreign member 1980, biology Centre National de la Recherche Scientifique 15, Quai Anatole France, 75-700 Paris, France

Alwyn WILLIAMS (1921), foreign member 1980, paleontology, zoology University of Glasgow, Glasgow, G 12 800, Scotland; Great Britain

Kunio YAGI (1919), foreign member 1980, biochemistry University of Nagoya, Japan



### Section III--Mathematical, Physical and Chemical Sciences

Anatoly Petrovich ALEKSANDROV (1903), foreign member 1977, physics  
USSR Academy of Sciences, Leninskiy Prospekt No 14, 117-901 Moscow USSR

Pavel Sergeyevich ALEKSANDROV (1896), foreign member 1959, mathematics  
Moscow University imeni M. Lomonosov, korp. L apt 9, 117-234 Moscow, USSR

Nikolay Gennadevich BASOV (1922), foreign member 1977, theoretical and applied  
physics  
Physics Institute, USSR Academy of Sciences, Leninskiy Prospekt NO 53, Moscow  
111-333, USSR

R.H.Bing (1914), foreign member 1980, mathematics, topology  
University of Texas, Austin, Texas

Nikolay Nikolayevich BOGOLUBOV (1909), foreign member 1962, mathematics, physics  
[Objedinionnyj Institut Jadiernych Issledowanij] United Institute for Nuclear  
Research, Dubna, USSR

Niels Aage BOHR (1922), foreign member 1980, nuclear physics  
Kobenhavns Universitet Niels Bohr Institutet, Blegdamsvej 17, 2100 Kobenhavn,  
Denmark

Friedrich CRAMER (1923), foreign member 1980, chemistry  
Max-Planck-Institut fur Experimentelle Medizin, Hermann-Rein-Strasse 3,  
D-3400 Gottingen, FRG

Richard H. DALITZ (1925), foreign member 1980, theoretical physics  
University of Oxford, Department of Theoretical Physics, 1 Keble Road, Oxford  
OX1 3NP, Great Britain

Nikolay Markovich EMANUEL (1915), foreign member 1977, physical chemistry  
Vorobevskoe Shose 2b apt 44, 117 334 Moscow USSR

Piotr Leonidovich KAPICA (1894), foreign member 1962, physics  
USSR Academy of Sciences, Leninskiy Prospekt NO 14, 117-901 Moscow USSR

Alfred KASTLER (1902), foreign member 1967, physics  
14 rue Lhomond, Paris V-e, France

Hermann KLARE (1909), foreign member 1977, chemistry  
Deutsche Akademie der Wissenschaften der DDR, Otto-Nuschke-Strasse 22/23  
108 Berlin, GDR

Andrey Nikolayevich KOLMOGOROV (1903), foreign member 1956, mathematics  
Moscow University imeni Lomonosov, korp. L, apt 10, Moscow USSR

Nelson J. LEONARD (1916), foreign member 1977, organic chemistry, biochemistry  
Center for Advanced Study, University of Illinois at Urbana-Champaign, Urbana,  
Illinois

Jean LERAY (1906), foreign member 1977, mathematics, mechanics  
6 Ave Jean Racine, 92 330, Sceaux, Paris, France

Louis E.F. NEEL (1904), foreign member 1974, physics  
15 rue Marcel-Allegot, 92190 Meudon-Bellevue, France

Aleksandr Nikolayevich NIESMEYANOV (1899), foreign member 1954, organic chemistry  
USSR Academy of Sciences, Leninskiy Prospekt No 14, 117-901 Moscow, USSR

Sergey Mixailovich NIKOLSKYY (1905), foreign member 1980, mathematics  
Leninskiy Prospekt 61/1 apt 28, 117-333 Moscow USSR

Linus Carl PAULING (1901), foreign member 1967, chemistry  
Stanford University, Stanford, California 94305

Jozef ROTBLAT (1908), foreign member 1966, physics  
8 Asmara Road, London NW 2, Great Britain

Gleen T. SEABORG (1912), foreign member 1974, physicochemistry  
Lawrence Berkeley Laboratory, University of California, Berkeley, Calif. 94720

Nikolay Nikolayevich SEMYONOV (1896), foreign member 1974, physicochemistry  
USSR Academy of Sciences, Leninskiy Prospekt No 14, 117-901 Moscow, USSR

Viktor Ivanovich SPITSYN (1902), foreign member 1980, inorganic chemistry and physical chemistry  
Institute of Physical Chemistry, USSR Academy of Sciences, Leninskiy Prospekt, No 31, 117 312 Moscow, USSR

Alexander Robertus TODD (1907), foreign member 1970, organic chemistry  
University of Cambridge, Cambridge, Great Britain

Serjey Vasilevich VONSOVSKIY (1910), foreign member 1977, physics  
620 014 Sverdlovsk L-14, ul. 8-go Marta [8-March St] No 2 apt 25

Antoni ZYGMUND (1900), foreign member 1959, mathematics  
University of Chicago, Chicago 37, Illinois

#### Section IV --Technical Sciences

Angel Tonchev BALEVSKIY (1910), foreign member 1971, physical and mechanical properties of metals  
Bulgarian Academy of Sciences, 7 Noemvri 1, Sofia, People's Republic of Bulgaria

Harold Everaldo Monteagle BARLOW (1899), foreign member 1966, electrotechnology  
University College, London, Gower St. London WC 1 Great Britain

Paul BASTIEN (1907), foreign member 1974, metallurgy  
85 Avenue Bosquet, Paris VII-e, France

George K. BATCHELOR (1920), foreign member 1974, hydromechanics  
University of Cambridge, Department of Applied Mathematics and Theoretical  
Physics, Silver Street, Cambridge CB 3 9 EV, Great Britain

Geza BOGNAR (1909), foreign member 1980, microwave theory and technology  
Magyar Tudomanyos Akademia, V., Roosevelt Ter 9, 1361 Budapest, Hungarian  
People's Republic

Leonid Maksimovich BREXOVSKIX (1917), foreign member 1977, acoustics  
USSR Academy of Sciences, Leninskiy Prospekt No 14, 117-901 Moscow USSR

Ferdinand CAMPUS (1894), foreign member 1960, theory of construction  
Institut de Genie Civil, 6, Quai Banning, Liege, Belgium

CHIEN-WEI-CHANG, foreign member 1956, applied mechanics  
3 Wen Ching Chien, Peking, People's Republic of China

Daniel C. DRUCKER (1918), foreign member 1980, applied mechanics  
University of Illinois at Urbana-Champaign, College of Engineering, 106  
Engineering Hall, Urbana, Illinois 61801

Paul GERMAIN (1920), foreign member 1977, mechanics  
3 Avenue de Champaubert, 75 015 Paris, France

Viktor Mixailovich GLUSHKOV (1923), foreign member 1977, cybernetics  
Institute of Cybernetics, Academy of Sciences of the Ukrainian SSR, Vladimirska  
St NO 54, Kiev USSR

Pierre Auguste GRIVET (1911), foreign member 1977, electronics  
Universite de Paris, Institut d'Electronique Fondamental, Batiment 220, 914 05  
Orsay, Paris Cedex, France

Aleksandr Yulyevich ISHLINSKIY (1913), foreign member 1977, mechanics  
Institute for Problems of Mechanics, USSR Academy of Sciences, Leninskiy  
Prospekt No 7, 125 040 Moscow, USSR

Vladimir Aleksandrovich KOTELNIKOV (1908), foreign member 1974, radio-electronics  
USSR Academy of Sciences, Leninskiy Prospekt No 14, 117-901 Moscow, USSR

Jaroslav KOZESNIK (1907), foreign member 1966, mechanics  
Nam. J. Machka 6, Prague 5--Kosire, Czechoslovakian Socialist Republic

Tadeusz Boleslaw MASSALSKI (1926), foreign member 1980, physics of metals  
Carnegie-Mellon University, Science Hall 4311, Department of Metallurgy and  
Materials Science, Schenley Park, Pittsburgh, Pennsylvania 15213

Charles E. MASSONNET (1914), foreign member 1980, theory of construction in  
engineering  
Universite de Liege, Institut de Genie Civil, Quai Banning 6, 4000 Liege Belgium

Folke K.G. ODQVIST (1899), foreign member 1962, mechanical engineering  
Hungr, Tekniska Hogskolan, Stockholm, Sweden

Milton C. SHAW (1915), foreign member 1977, mechanical engineering technology  
Arizona State University, College of Engineering and Applied Sciences,  
Tempe, Arizona 85281

Ian N. SNEDDON (1919), foreign member 1960, mathematics, theory of elasticity  
Glasgow University, Department of Mathematics, 5 University Garden, Glasgow  
W2, Great Britain

Nikolay Mixailovich ZHAVORONKOV (1907), foreign member 1977, physical chemistry  
and inorganic technology  
Institute of Foreign and Inorganic Chemistry [Institut Obszcej i Nieorganicznej  
Chimii] USSR Academy of Sciences, Leninskiy Prospekt No 31, 117 071 Moscow USSR

#### Section V--Agricultural and Forestry Sciences

Robert S. BANDURSKI (1924), foreign member 1980, plant physiology  
Michigan State University, Department of Botany and Plant Pathology, East  
Lansing, Michigan, 48824

Christo Stefan DASKALOV (1903), foreign member 1962, plant cultivation  
Bulgarian Academy of Sciences, 7 Noemvri 1, Sofia, People's Republic of  
Bulgaria

Artur HORN (1911), foreign member 1974, zootechnology  
Otthon u. 25, 1118 Budapest, Hungarian People's Republic

Stanislaw Kazimierz KON (1900), foreign member 1966, physiology and biochemistry  
of food  
Bramley Cottage, Langford Road, Lower Langford, Bristol, BS  
18 7 BL UK Great Britain

Andrey Lovovich KURSANOV (1902), foreign member 1966, plant physiology and  
biochemistry  
Leninskiy Prospekt No 13, apt 112, 117 071 Moscow, USSR

Hans LEIBUNDGUT (1909), foreign member 1977, forestry  
Stallikerstrasse 42, 9142 Uitikon, Switzerland

Pavel Pavlovich LOBANOV (1902), foreign member 1970, economics and organization  
of agriculture  
All-Soviet Academy of Agricultural Sciences [Wsiesojuznaja Akadiemija Siel-  
skochoziajstwiennych Nauk] imeni V. I. Lenin, Bol'shoy Xaritonovskiy pier. 21  
107 814 Moscow, USSR

Tadeusz MANN (1908), foreign member 1980, biochemistry and physiology of  
reproduction  
1 Courtney Way, Cambridge, England CB4 2EE, Great Britain

Daniel F. MILLIKAN (1918), foreign member 1974, phytopathology  
University of Missouri, Columbia, Missouri 65201

Hans STUBBE (1902), foreign member 1963, plant genetics  
Zentralinstitut für Genetik und Kulturpflanzenforschung, 4325 Gatersleben,  
Corrensstrasse 3 GDR

Ivan Semyonovich SHATILOV (1917), foreign member 1977, plant cultivation  
All-Soviet Academy of Agricultural Sciences imeni V. I. Lenin, Bol'shoy  
Kharitonovskiy pier. 21, 107 814 Moscow, USSR

Roger ULRICH (1905), foreign member 1977, plant physiology  
36 rue des Plantes, 750 14 Paris, France

Piotr Petrovich VAVILOV (1918), foreign member 1980, plant raising and  
cultivation  
All-Soviet Academy of Agricultural Sciences imeni V. I. Lenin, Bol'shoy  
Kharitonovskiy pier. 21, 107 814 Moscow, USSR

#### Section VI--Medical Sciences

Nikolay Nikolayevich BLOXIN (1912), foreign member 1962, surgery, oncology  
USSR Academy of Medical Sciences, Ul. Solanka [Solanka St] No 14, Moscow, USSR

Torbjorn Oscar CASPERSSON (1910), foreign member 1977, cellular biology  
Tumörpatologiska Institutionen, Karolinska Sjukhuset, 10401, Stockholm 60,  
Sweden

Jozef CHARVAT (1897), foreign member 1966, endocrinology  
Ostrovni 5 110 00 Prague 1 --Nove Mesto, CSSR

Ignacio CHAVEZ (1897), foreign member 1966, cardiology  
Paseo de la Reforma 1310, Lomas Mexico 10 D.F. Mexico

Tadeusz S. Danowski (1914), foreign member 1974, internal medicine  
Shadyside Hospital, Pittsburgh, 5230 Centre Avenue, Pennsylvania 15232

Georgiy Francevich GAUZE (1910), foreign member 1967, microbiology  
USSR Academy of Medical Sciences, Pirogovskaya St NO 11, Moscow, USSR

Jean HAMBURGER (1909), foreign member 1980, nephrology, immunology  
38 rue Mazarine, 75006 Paris VI-e, France

Stefan M. MILCU (1903), foreign member 1967, anthropology, endocrinology  
Boulevardul Dacia, 54-70256 Bucuresti 2, Socialist Republic of Romania

Francis Daniels MOORE (1913), foreign member 1977, surgery  
Harvard Medical School, Department of Surgery, The Countway Library,  
10 Shattuck Street, Boston, Massachusetts 02115

Boris Vasilevich PETROVSKIY (1908), foreign member 1974, surgery  
USSR Academy of Medical Sciences, Solanka St No 14, Moscow, USSR

Sigvald REFSUM (1907), foreign member 1977, neurology  
Department of Neurology, Rikshospitalet, Oslo 1, Norway

Lev Manusevich SABAD (1902), foreign member 1962, oncology  
USSR Academy of Medical Sciences, Volokolamskoe Shosse No 30, Moscow, USSR

Janos SZENTAGOTTHAI (1912), foreign member 1980, corrective anatomy  
Magyar Tudomanyos Akademia, 1361 Budapest, V., Roosevelt Ter 9, Hungarian  
People's Republic

Hugo THEORELL (1903), foreign member 1959, biochemistry  
Medicinska Nobelinstitutet, Biokemiska Avdelningen, Solnavagen 1, Stockholm  
60, Sweden

John Robert VANE (1927), foreign member 1980, pharmacology  
The Wellcome Research Laboratories, Langley Court, Beckenham, Kent, BR 3 3BS,  
Great Britain

#### Section VII--Earth Sciences and Mining Sciences

Preston CLOUD (1912), foreign member 1980, geology  
University of California, Department of Geological Sciences, Santa Barbara,  
California 93106

Jean BRESCH (1905), foreign member 1980, geomorphology, physical geography  
82 rue Notre Dame des Champs, 75006 Paris, France

Michel DURAND-DELGA (1923), foreign member 1980, regional and structural  
geology  
Universite Paul Sabatier, Laboratoire de Geologie Mediterranee, 38, rue  
des Trente-Six Ponts, 31078 Toulouse, Cedex, France

Svetozar ILESIC (1907), foreign member 1980, geography  
61000 Ljubljana, Trstenjakova 9, Socialist Federated Republic of Yugoslavia

Antal TARCZY-HORNOCH (1900), foreign member 1977, geodesy  
Madach u. 5, Sopron H-9400, Hungarian People's Republic

#### Deceased Members of the Academy

##### National Members

Kazimierz AJDUKIEWICZ (1890-1963)  
regular member 1952, logic

Wlodzimierz ANTONIEWICZ (1893-1973)  
titular member 1952, regular member 1957, primeval archeology and archeology  
of the early Middle Ages

Stanislaw ARNOLD (1895-1973)  
corresponding member 1952, regular member 1958, economic history of Poland

Stanislaw BAC (1887-1970)  
corresponding member 1958, regular member 1961, water, farm and forest  
reclamation

Stefan BALEY (1885-1952)  
titular member 1952, psychology

Tadeusz BANACHIEWICZ (1882-1954)  
titular member 1952, astronomy

Stefan BARBACKI (1903-1979)  
corresponding member 1952, regular member 1964, plant genetics and breeding

Kazimierz BASSALIK (1879-1960)  
titular member 1952, regular member 1957, microbiology, plant physiology

Stanislaw BATAWIA (1898-1980)  
corresponding member 1965, regular member 1969, criminology

Stanislaw BELLERT (1924-1976)  
corresponding member 1973, electronics

Czeslaw BIALOBRZESKI (1878-1953)  
titular member 1952, physics

Wladyslaw BIELANSKI (1911-1982)  
corresponding member 1969, regular member 1976, biology of animal reproduction

Andrzej BIERNACKI (1903-1963)  
corresponding member 1954, internal diseases

Witold BIERNAWSKI (1898-1957)  
corresponding member 1954, regular member 1966, machining

Wlodzimierz BOBROWNICKI (1892-1980)  
corresponding member 1954, regular member 1966, technology of inorganic chemistry

Julian BONDER (1900-1975)  
corresponding member 1954, regular member 1966, hydro- and aeromechanics

Karol BORSUK (1905-1982)  
corresponding member 1952, regular member 1956, topology

Stanislaw BRETZNAJDER (1907-1967)  
corresponding member 1954, regular member 1961, chemistry

Juliusz BRILL (1901-1981)  
corresponding member 1965, regular member 1973, microbiology

Henryk BROKMAN (1886-1976)  
corresponding member 1954, regular member 1966, pediatrics

Michal BROSZKO (1880-1954)  
titular member 1952, hydromechanics

Witold BUDRYK (1891-1958)  
regular member 1952, mining

Franciszek BUJAK (1875-1953)  
titular member, economic history

Jan BYSTRON (1892-1964)  
titular member 1952, ethnology

Romuald CEBERTOWICZ (1897-1981)  
corresponding member 1952, regular member 1980, hydraulics and hydrology, soil mechanics and foundation engineering

Jozef CHALASINSKI (1904-1979)  
regular member 1952, sociology

Emil CHROBOCZEK (1902-1978)  
corresponding member 1954, regular member 1966, market gardening

Adolf CHYBINSKI (1880-1952)  
titular member 1952, musicology

Waclaw CYBULSKI (1901-1973)  
corresponding member 1964, regular member 1971, mining

Mieczyslaw CZAJA (1903-1958)  
corresponding member 1954, animal breeding

Jan CZEKANOWSKI (1882-1965)  
titular member 1952, regular member 1957, anthropology

Franciszek CZUBALSKI (1885-1965)  
titular member 1952, regular member 1957, human physiology

Zygmunt CZUBINSKI (1912-1967)  
corresponding member 1960, plant taxonomy and geography

Jan DABROWSKI (1890-1965)  
regular member 1952, general history

August DEHNEL (1903-1962)  
corresponding member 1958, zoology

Felicjan DEMBINSKI (1901-1981)  
corresponding member 1960, regular member 1969, in-depth plant cultivation



Jan DEMBOWSKI (1889-1963)  
regular member 1952, biology

Szczesny DETTLOFF (1878-1961)  
titular member 1952, regular member 1957, art history

Antoni Boleslaw DOBROWOLSKI (1872-1954)  
titular member 1952, pedagogy, geography

Stanislaw DOKTOROWICZ-HREBNICKI (1888-1974)  
corresponding member 1954, geology

Witold DOROSZEWSKI (1899-1976)  
corresponding member 1952, regular member 1956, linguistics

Jan DYLIK (1905-1973)  
corresponding member 1967, geography, geomorphology

Wladyslaw DZIEWULSKI (1878-1962)  
titular member 1952, regular member 1957, astronomy

Franciszek FIEDLER (1880-1956)  
regular member 1952, history of social thought

Ludwik FLECK (1896-1961)  
corresponding member 1954, immunology

Stanislaw FRYZE (1885-1964)  
titular member 1952, regular member 1957, electrotechnology

Natalia GASIOROWSKI-GRABOWSKA (1881-1964)  
regular member 1952, history of Poland

Jerzy GIERULA (1917-1975)  
corresponding member 1969, nuclear physics

Walery GOETEL (1889-1972)  
corresponding member 1952, regular member 1964, geology

Marian GORSKI (1886-1961)  
corresponding member 1958, regular member 1961, agricultural chemistry, soil sciences

Jerzy GROCHOWSKI (1899-1980)  
corresponding member 1954, regular member 1966, dendrometry

Franciszek GROER (1887-1965)  
corresponding member 1954, pediatrics

Konstanty GRZYBOWSKI (1901-1970)  
corresponding member 1969, law

Romuald GUTT (1888-1974)

titular member 1952, regular member 1971, architecture

Jozef HELLER (1896-1982)

corresponding member 1952, regular member 1961, comparative biology

Stanislaw HEMPEL (1892-1954)

corresponding member 1952, steelwork

Ludwik HIRSZFELD (1884-1954)

regular member 1952, immunology, microbiology

Tadeusz HOBLER (1899-1975)

corresponding member 1954, regular member 1966, chemical engineering

Boleslaw HRYNIEWIECKI (1875-1963)

titular member 1952, regular member 1957, botany

Stanislaw HUECKEL (1911-1980)

corresponding member 1962, regular member 1971, foundation engineering, harbor engineering

Leopold INFELD (1898-1968)

regular member, 1958, philosophy

Aleksander JABLONSKI (1898-1980)

corresponding member 1956, regular member 1961, experimental physics

Tadeusz JACZEWSKI (1899-1974)

corresponding member 1952, zoology

Jozef JANICKI (1904-1980)

corresponding member 1962, regular member 1971, chemistry and technology of food products

Maurycy JAROSZYNSKI (1890-1974)

corresponding member 1958, regular member 1964, law

Marcin KACPRZAK (1888-1968)

corresponding member 1962, hygiene

Michal KALECKI (1899-1970)

corresponding member 1958, regular member 1966, political economics

Sylwester KALISKI (1925-1978)

corresponding member 1962, regular member 1969, applied mechanics and technical physics

Bogdan KAMIENSKI (1897-1973)

corresponding member 1952, regular member 1961, chemistry

Czeslaw KANAFOJSKI (1898-1981)  
corresponding member 1952, regular member 1961, farm machinery

Laura KAUFMAN (1889-1972)  
corresponding member 1956, regular member 1958, animal breeding and genetics

Lucjan KAZNOWSKI (1890-1955)  
corresponding member 1952, plant cultivation

Juliusz KLEINER (1886-1957)  
regular member 1952, history of Polish literature

Zenon KLEMENSIEWICZ (1891-1969)  
corresponding member 1954, regular member 1961, linguistics

Tadeusz KONOPINSKI (1894-1965)  
corresponding member 1960, animal breeding

Jerzy KONORSKI (1903-1973)  
corresponding member 1956, regular member 1966, neurophysiology

Boleslaw KORDAS (1933-1981)  
corresponding member 1979, hydraulics, hydrology, water economics

Jozef KOSTRZEWSKI (1885-1969)  
titular member 1952, regular member 1957, archeology

Jan KOSZCZYC-WITKIEWICZ (1881-1958)  
titular member 1952, history of architecture

Tadeusz KOTARBINSKI (1886-1981)  
regular member 1952, philosophy, logic, praxeology

Roman KOZLOWSKI (1889-1977)  
regular member 1952, paleontology

Stanislaw KRAUSS (1901-1973)  
corresponding member 1964, epizootiology

Alfons KRAUZE (1895-1972)  
corresponding member 1958, chemistry

Boleslaw KRUPINSKI (1893-1972)  
corresponding member 1961, mining

Aleksander KRUPKOWSKI (1894-1978)  
regular member 1952, metallurgy

Julian KRZYZANOWSKI (1892-1976)  
titular member 1952, regular member 1956, history of Polish literature

Marian KSIAZKIEWICZ (1906-1981)  
corresponding member 1952, regular member 1969, regional geology, sedimentology

Stanislaw KULCZYNSKI (1895-1975)  
regular member 1952, morphology and taxonomy of plants

Kazimierz KUMANIECKI (1905-1977)  
corresponding member 1956, regular member 1961, classical philology

Kazimierz KURATOWSKI (1896-1980)  
regular member 1952, topology, set theory, mathematical logic

Jerzy KURYLOWICZ (1895-1978)  
regular member 1952, linguistics

Julian LAMBOR (1901-1973)  
corresponding member 1962, hydrology and water economics

Wiktor LAMPE (1875-1962)  
titular member 1952, regular member 1957, chemistry

Anastazy LANDAU (1876-1957)  
titular member 1952, regular member 1957, internal diseases

Oskar LANGE (1904-1965)  
regular member 1952, political economy

Jozef LASKOWSKI (1900-1970)  
corresponding member 1960, regular member 1969, oncopathology

Tadeusz LEHR-SPLAWINSKI (1891-1965)  
regular member 1952, Slavic philology

Michal LUNC (1908-1974)  
corresponding member 1958, regular member 1966, hydro- and aeromechanics

Kazimierz MAJEWSKI (1903-1981)  
corresponding member 1952, regular member 1966, classical archeology

Edmund MALINOWSKI (1885-1979)  
titular member 1952, regular member 1957, genetics

Tadeusz MALKIEWICZ (1904-1981)  
corresponding member 1971, physical metallurgy

Tadeusz MANTEUFFEL (1902-1970)  
corresponding member 1952, regular member 1958, general history of the Middle Ages

Teodor MARCHLEWSKI (1899-1962)  
regular member 1952, evolutionism and genetics of animals

Edward MARCZEWSKI (1907-1976)  
corresponding member 1958, regular member 1966, mathematics

Stanislaw MAZUR (1905-1981)  
regular member 1952, mathematics

Zdzislaw MACZENSKI (1878-1961)  
corresponding member 1956, architecture

Mieczyslaw MICHALOWICZ (1876-1965)  
titular member 1952, regular member 1957, pediatrics

Kazimierz MICHALOWSKI (1901-1981)  
regular member 1952, Mediterranean archeology

Edmund MIKULASZEK (1895-1978)  
corresponding member 1952, regular member 1956, medical microbiology

Tadeusz MILOBEDZKI (1873-1959)  
titular member 1952, regular member 1957, chemistry

Witold MINKIEWICZ (1880-1961)  
titular member 1952, architecture

Jan MIODONSKI (1902-1963)  
corresponding member 1952, regular member 1961, otolaryngology

Franciszek MISZTAL (1901-1981)  
corresponding member 1958, regular member 1964, mechanics, plane construction

Zygmunt MOCZARSKI (1876-1957)  
titular member 1952, animal breeding

Zygmunt MODZELEWSKI (1900-1954)  
regular member 1952, history of social thought

Andrzej MOSTOWSKI (1913-1975)  
corresponding member 1956, regular member 1966, mathematics

Kazimierz MOSZYNSKI (1887-1959)  
titular member 1952, regular member 1957, ethnology, ethnography

Waclaw MOSZYNSKI (1892-1953)  
corresponding member 1952, mechanical engineering

Leon MROCZKIEWICZ (1900-1971)  
corresponding member 1967, silviculture

Arkadiusz MUSIEROWICZ (1894-1966)  
corresponding member 1954, regular member 1958, soil sciences

Jan MYDLARSKI (1892-1956)  
corresponding member 1952, anthropology

Henryk NIEWODNICZANSKI (1900-1968)  
corresponding member 1952, regular member 1961, physics

Kazimierz NITSCH (1874-1958)  
regular member 1952, linguistics

Pawel NOWACKI (1905-1979)  
corresponding member 1956, regular member 1961, energy engineering

Franciszek NOWOTNY (1904-1972)  
corresponding member 1969, agricultural-food technology

Stanislaw OCHEDUSZKO (1899-1969)  
corresponding member 1960, theory of heating equipment

Jan OLBRYCHT (1886-1968)  
regular member 1958, forensic medicine

Waclaw OLSZAK (1902-1980)  
corresponding member 1954, regular member 1956, theory of plasticity

Adam OPALSKI (1897-1963)  
corresponding member 1952, neuropathology

Witold ORLOWSKI (1874-1966)  
titular member 1952, regular member 1957, internal diseases

Jan OSZACKI (1915-1982)  
corresponding member 1967, regular member 1980, general surgery

Ludwik PASZKIEWICZ (1878-1967)  
regular member 1952, pathological anatomy

Bogumil PAWLOWSKI (1898-1971)  
corresponding member 1952, regular member 1966, botany

Kazimierz PETRUSIEWICZ (1906-1982)  
corresponding member 1952, regular member 1966, evolutionism and ecology of animals

Stefan PIENKOWSKI (1883-1953)  
regular member 1952, physics

Stanislaw PIGON (1885-1968)  
titular member 1952, regular member 1957, history of Polish literature

Eugeniusz PIJANOWSKI (1906-1974)  
corresponding member 1952, regular member 1961, agricultural-food technology

Kazimierz PIWARSKI (1903-1968)  
corresponding member 1958, regular member 1961, general history

Bohdan PNIEWSKI (1897-1965)  
corresponding member 1952, regular member 1958, architecture

Adolf POLAK (1890-1967)  
corresponding member 1954, internal combustion engine

Wenczeslaw PONIZ (1900-1967)  
corresponding member 1960, mechanical theory and engineering

Stefan POZNANSKI (1922-1982)  
corresponding member 1976, food chemistry and technology

Roman PRAWOCHENSKI (1877-1965)  
titular member 1952, animal breeding

Stanislaw PROSINSKI (1912-1975)  
corresponding member 1971, chemical wood technology

Zdzislaw RAABE (1909-1972)  
corresponding member 1965, regular member 1971, protozoology

Ignacy REIFER (1909-1971)  
corresponding member 1964, biochemistry

Blazej ROGA (1895-1977)  
corresponding member 1960, regular member 1971, chemical coal technology

Eugeniusz ROMER (1871-1954)  
titular member 1952, geography

Stefan ROZMARYN (1908-1969)  
corresponding member 1952, regular member 1961, law

Wojciech RUBINOWICZ (1889-1974)  
regular member 1952, physics

Stanislaw RYZKO (1910-1974)  
corresponding member 1967, electronics

Antoni SALUSTROWICZ (1899-1967)  
corresponding member 1961, mining mechanics

Jan SAMSONOWICZ (1888-1959)  
corresponding member 1952, regular member 1956, geology

Msciwój SEMERAU-SIEMIANOWSKI (1885-1953)  
titular member 1952, cardiology

Waclaw SIERPINSKI (1882-1969)  
regular member 1952, mathematics

Tadeusz SINKO (1877-1966)  
titular member 1952, regular member 1957, classical philology

Boleslaw SKARZYNSKI (1901-1963)  
corresponding member 1952, regular member 1961, biochemistry

Stanislaw SKOWRON (1900-1976)  
corresponding member 1952, biology

Andrzej SOLTAN (1897-1959)  
corresponding member 1952, physics

Jan STACH (1877-1975)  
regular member 1958, zoology

Juliusz STARZYNSKI (1906-1974)  
corresponding member 1952, regular member 1966, history of art

Bohdan STEFANOWSKI (1883-1976)  
regular member 1952, theory of heating equipment

Witold STEFANSKI (1891-1973)  
corresponding member 1952, regular member 1956, parasitology

Hugo STEINHAUS (1887-1972)  
regular member 1952, mathematics

Zdzislaw STIEBER (1903-1980)  
corresponding member 1954, regular member 1961, Slavic philology

Janusz SUPNIEWSKI (1899-1964)  
corresponding member 1952, regular member 1961, pharmacology

Jerzy SUSZKO (1889-1964)  
corresponding member 1952, regular member 1958, chemistry

Wladyslaw SZAFER (1886-1970)  
regular member 1952, paleobotany, plant taxonomy and geography

Jacek SZARSKI (1921-1980)  
corresponding member 1969, differential equations

Szczepan SZCZENIOWSKI (1898-1979)  
corresponding member 1964, regular member 1973, physics

Olech SZCZEPSKI (1914-1980)  
regular member 1976, pediatrics



Franciszek SZELAGOWSKI (1898-1973)  
corresponding member 1952, regular member 1961, bridge construction

Stefan SZULC (1881-1956)  
corresponding member 1956, statistics

Zygmunt SZYMANOWSKI (1873-1956)  
titular member 1952, bacteriology

Stanislaw SLIWINSKI (1887-1959)  
corresponding member 1952, regular member 1958, law

Henryk SWIDZINSKI (1904-1969)  
corresponding member 1965, geology

Boleslaw SWIETOCHOWSKI (1895-1975)  
corresponding member 1952, regular member 1961, soil and crop cultivation

Wojciech SWIETOSLAWSKI (1881-1968)  
regular member 1952, chemistry

Witold TASZYCKI (1898-1979)  
corresponding member 1956, regular member 1961, linguistics

Wladyslaw TATARKIEWICZ (1886-1980)  
regular member 1956, philosophy, art history

Rafal TAUBENSCHLAG (1881-1958)  
titular member 1952, regular member 1957, papyrology

Henryk TEISSEYRE (1903-1975)  
corresponding member 1954, regular member 1969, geology

Tadeusz TEMPKA (1885-1974)  
corresponding member 1952, regular member 1961, internal diseases

Stanislaw THUGUTT (1862-1956)  
titular member 1952, mineralogy, petrography

Julian TOKARSKI (1883-1961)  
titular member 1952, regular member 1957, mineralogy, soil sciences

Kazimierz TYMIENIECKI (1887-1968)  
titular member 1952, regular member 1957, general history

Jan WASILKOWSKI (1898-1977)  
corresponding member 1952, regular member 1958, law

Zbigniew WASIUTYNSKI (1902-1974)  
corresponding member 1958, regular member 1966, theory of engineering design

Tadeusz WAZEWSKI (1896-1972)  
corresponding member 1952, regular member 1958, mathematics

Jan WEYSENHOFF (1889-1972)  
corresponding member 1958, regular member 1966, physics

Stanislaw WEDKIEWICZ (1888-1963)  
titular member 1952, regular member 1957, Romance language studies

Witold WIERZBICKI (1890-1965)  
regular member 1952, structural analysis [in building construction]

Jozef WITKOWSKI (1892-1976)  
corresponding member 1959, astronomy

Zygmunt WOJCIECHOWSKI (1900-1955)  
regular member 1952, history

Tadeusz WOLSKI (1890-1959)  
corresponding member 1952, morphology and taxonomy of plants

Kazimierz WYKA (1910-1975)  
corresponding member 1952, regular member 1961, history of Polish literature

Ludwik ZABROCKI (1907-1977)  
corresponding member 1971, German language studies

Ananiasz ZAJACZKOWSKI (1903-1970)  
corresponding member 1952, regular member 1961, orientalist

Witold ZAWADOWSKI (1888-1980)  
corresponding member 1952, regular member 1957, radiology

Jadwiga ZIEMIECKA (1891-1968)  
corresponding member 1952, regular member 1958, general microbiology

Juliusz ZWEIBAUM (1887-1959)  
corresponding member 1952, histology and embryology

Waclaw ZENCZYKOWSKI (1897-1957)  
corresponding member 1952, general construction

Kazimierz ZORAWSKI (1886-1953)  
titular member 1952, mathematics

## Foreign Members

Roger ADAMS (1889-1972)  
foreign member 1959, chemistry; United States

Nikolay N. ANDREYEV (1880-1975)  
foreign member 1960, acoustics; USSR

Mixail I. ARTAMONOV (1898-1972)  
foreign member 1959, archeology; USSR

Ranuccio Bianchi BANDINELLI (1900-1975)  
foreign member 1962, art history; Italy

Istvan BARTA (1910-1978)  
foreign member 1967, electrotechnology; Hungarian People's Republic

Jules BASDEVANT (1877-1968)  
foreign member 1959, law; France

Vladimir N. BEKLEMISHEV (1890-1962)  
foreign member 1959, zoology; USSR

Aleksander BELIC (1894-1960)  
foreign member 1956, linguistics; Socialist Federal Republic of Yugoslavia

Emile BENVENISTE (1902-1976)  
foreign member 1959, linguistics; France

John Desmond BERNAL (1901-1971)  
foreign member 1954, physics, history of learning; Great Britain

Nikolay Vasilevich BELOV (1891-1982)  
foreign member 1977, crystal chemistry, geological chemistry; USSR

Niels BOHR (1885-1962)  
foreign member 1959, physics; Denmark

Iosias BRAUN-BLANQUET (1884-1980)  
foreign member 1959, botany; France

Piotr P. BUDNIKOV (1885-1968)  
foreign member 1956, chemistry; USSR

Paul CAZIN (1881-1963)  
foreign member 1956, Slavic studies; France

Edward CECH (1893-1956)  
foreign member 1956, mathematics; CSSR

Gustavo COLONNETTI (1886-1968)  
foreign member 1963, theoretical and applied mechanics; Italy

Jean DEBIESSE (1907-1978)  
foreign member 1971, technical physics; France

Rebert DEBRE (1882-1978)  
foreign member 1959, pediatrics; France

Arnaud DENJOY (1884-1973)  
foreign member 1962, mathematics; France

Leopold ESCANDE (1902-1980)  
foreign member 1960, hydropower engineering, hydraulics; France

Jean FABRE (1904-1975)  
foreign member 1959, history of literature; France

Guido FANCONI (1892-1979)  
foreign member 1962, pediatrics; Switzerland

Leopold FEJER (1880-1959)  
foreign member 1959, mathematics; Hungarian People's Republic

Aleksandr N. FRUMKIN (1895-1976)  
foreign member 1956, chemistry, electrochemistry; USSR

Sandor GELEJI (1899-1967)  
foreign member 1966, metallurgy; Hungarian People's Republic

Jacques HADAMARD (1865-1963)  
foreign member 1956, mathematics: France

Jaroslav HEYROVSKY (1890-1967)  
foreign member 1962, chemistry; CSSR

Roman JAKOBSON (1896-1982)  
foreign member 1959, linguistics: United States

Fryderyk JOLIOT-CURIE (1900-1958)  
foreign member 1954, physics; France

David KEILIN (1887-1963)  
foreign member 1959, biochemistry; Great Britain

Radim KETTNER (1891-1967)  
foreign member 1956, geology; CSSR

Mstislav V. KELDYSH (1911-1978)  
foreign member 1962, mechanics, mathematics; USSR

Maksymilian KLINKOWSKI (1904-1971)  
foreign member 1967, plant virusology; GDR

Halvdan KOHT (1873-1965)  
foreign member 1959, history; Norway

Evgeniy A. KOSMINSKIY (1886-1959)  
foreign member 1959, history; USSR

Gleb M. KRZYZANOWSKI (1872-1959)  
foreign member 1956, electrotechnology; USSR

KUO-MO-JO (1892-1978)  
foreign member 1954, archeology, literary history; PRC

Michal LASKOWSKI (1905-1981)  
foreign member 1974, biochemistry; United States

Bertil LINDBLAT (1895-1965)  
foreign member 1959, astronomy; Sweden

Gyorgy LUKACS (1885-1971)  
foreign member 1956, philosophy; Hungarian People's Republic

Rezso Rudolphe MANNINGER (1890-1970)  
foreign member 1967, microbiology; Hungarian People's Republic

Mixail LAVRENTEV (1900-1980)  
foreign member 1970, mathematics; USSR

Mixail S. MASLOV (1885-1961)  
foreign member 1956, pediatrics; USSR

Giovanni MAVER (1898-1970)  
foreign member 1956, Slavic studies; Italy

Andre MAZON (1881-1967)  
foreign member 1956, Slavic studies; France

Ernst MELAN (1890-1963)  
foreign member 1960, theory of engineering design; Austria

Grigore C. Moisil (1906-1973)  
foreign member 1967, mechanics, automatics; Socialist Republic of Romania

Paul MONTEL (1876-1975)  
foreign member 1959, mathematics; France

Marston MORSE (1892-1977)  
foreign member 1963, mathematics; United States

Nikolay I. MUSHELISZVILI (1891-1976)  
foreign member 1960, theory of elasticity

Costin D. NENITESCU (1902-1972)  
foreign member 1967, chemistry; Socialist Republic of Romania

Zdenek NEYEDLY (1878-1962)  
foreign member 1954, history; CSSR

Jerzy NEYMAN (1894-1981)  
foreign member 1966, mathematics, statistics; United States

Miron C. NICOLESCU (1903-1975)  
foreign member 1971, mathematics; Socialist Republic of Romania

Ronald G. W. NORRISH (1897-1978)  
foreign member 1962, chemistry; Great Britain

Aleksandr V. PALLADIN (1885-1972)  
foreign member 1954, biochemistry; USSR

Heinz PARKUS (1909-1982)  
foreign member 1967, mechanics, theory of elasticity; Austria

Todor P. PAVLOV (1890-1977)  
foreign member 1962, philosophy; People's Republic of Bulgaria

Evgeniy N. PAVLOVSKIY (1883-1965)  
foreign member 1959, parasitology; USSR

Jan V. PEYVE (1907-1977)  
foreign member 1971, agricultural chemistry; USSR

Wilder PENFIELD (1891-1976)  
foreign member 1962, neurosurgery; Canada

Mauro PICONE (1885-1977)  
foreign member 1956, mathematics; Italy

Boris N. PETROV (1913-1980)  
foreign member 1974, automatics: USSR

William PRAGER (1903-1980)  
foreign member 1959, design theory, theory of plasticity; United States

Mirko ROS (1879-1962)  
foreign member 1956, resistance of construction materials; Switzerland

Edward John RUSSEL (1872-1965)  
foreign member 1959, agriculture, Great Britain

Istvan RUSZNYAK (1889-1976)  
foreign member 1962, internal medicine; Hungarian People's Republic

Leopold RUZICKA (1887-1976)  
foreign member 1959, chemistry; Switzerland

Aleksandr M. SAMARIN (1902-1970)  
foreign member 1962, metallurgy; USSR

Heinrich F. SCHMID (1896-1963)  
foreign member 1959, history; Austria

Konstantin I. SKRIABIN (1878-1972)  
foreign member 1959, parasitology; USSR

Vadim V. SOKOLOVSKIY (1910-1978)  
foreign member 1959, theory of plasticity; USSR

Frantisek SORM (1913-1980)  
foreign member 1966, organic chemistry; CSSR

Adolf STENDER-PETERSEN (1886-1963)  
foreign member 1962, Slavic studies; Denmark

Franz Johannes STROUX (1886-1954)  
foreign member 1954, classical philology; GDR

Stanislav G. STRUMILIN (1877-1975)  
foreign member 1967, political economy; USSR

Vladimir N. SUKACHEV (1880-1971)  
foreign member 1959, botany; USSR

Igor E. TAMM (1895-1971)  
foreign member 1959, physics; USSR

Geoffrey TAYLOR (1886-1975)  
foreign member 1970, hydromechanics and pneumatics; Great Britain

Erich THILO (1898-1978)  
foreign member 1959, chemistry; GDR

Mixail N. TIXOMIROV (1893-1965)  
foreign member 1959, history; USSR

Pavel TERENCEV (1897-1970)  
foreign member 1970, zoology; USSR

Arne TISELIUS (1902-1971)  
foreign member 1959, chemistry; Sweden

Ivan V. TIURIN (1892-1960)  
foreign member 1959, soil sciences; USSR

Joseph VENDRYES (1875-1960)  
foreign member 1959, linguistics; France

Aleksandr P. VINOGRADOV (1896-1975)  
foreign member 1974, chemistry, geochemistry; USSR

Viktor V. VINOGRADOV (1895-1970)  
foreign member 1959, linguistics; USSR

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## SATELLITE, AIRBORNE REMOTE SENSING DEVELOPMENT OUTLINED

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[Article by Bogdan Ney: "Satellite and Airborne Remote Sensing"\*]

[Text]

## PRINCIPLES OF REMOTE SENSING

Remote sensing is based on remote detection, surveying and scanning of objects with the aid of electromagnetic waves. Electromagnetic waves emitted by objects and registered on an information carrier with the aid of a receiver (detector) allow to identify the features of these objects. Most remote sensing technology uses passive devices. The source of electromagnetic radiation in them is the sun. The objects emit a portion of the energy they receive from the sun; this emission continues even with a time delay (explaining why the radiation takes place even at night). Other so-called "active" method of remote sensing use their own sources of radiation. Different regions of the electromagnetic wavelengths are used in remote sensing. Along with visible light and various selected bands of this light, ultraviolet rays, photographic infrared waves and far-infrared or thermal radiation, as well as microwaves, are used. Fragments of radiation regions are reflected in such a way that the best imaging of various objects for their characteristics can be attained. In scanning aimed at recognizing numerous objects or diverse features of one object, several wavelength regions are used at the same time.

The physical components of remote sensing are the following: detector carriers, detectors (devices) for searching for information about objects, carriers of this information, devices assisting or replacing human operators in processing and interpretation of information, and playback of final information adapted to be used by the recipient of the scanning results.

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\*Abridged version of a paper presented at a session of the Seventh Section of the Polish Academy of Sciences on Oct 20, 1982. The presentation was illustrated by posters, maps and slides. For technical reasons, illustrations are not reproduced here.

Remote sensing is an interdisciplinary area of methodology. Primarily it is a tool of research or work used in various areas of science and practical activity. It also has its own peculiar research problems which make it a scientific or technical discipline in its own right. In this paper, remote sensing is discussed from the point of view of earth exploration, specifically the natural and artificial surface of the earth and lower layers of its atmosphere.

### Principal Data Collection Techniques

The oldest data collection techniques used in aerial and satellite remote sensing come from conventional photography and photogrammetry. They use photographic equipment and photogrammetric cameras to search information and light-sensitive material as a carrier of images. Panchromatic and colored pictures or maps are final data carriers.

Multispectral cameras also belong to photographic techniques. They produce multispectral and spectral-band records, mainly using four to nine channels (radiation regions). For example, MKF-6 camera, a GDR and USSR design, has been used on satellites since 1976 (Soyuz 22); it has six channels for visible light and near-infrared radiation. One picture shot by this camera from a height of 265 km covers an earth terrain of 165 X 115 km. In Poland, we have Japanese multispectral NAC cameras. These use four spectral regions, including colors: blue, green, red and photographic infrared. For data collection in far-infrared or thermal regions, thermal and thermal profile cameras are used with television techniques (thermoevision). Images played on a monitor can be fixed as black and white photographs (thermographs) and color compositions created on their basis. In Poland, some 20 thermal cameras are in use at various centers. Most common are devices manufactured by the Swedish firm AGA, featuring temperature resolution capacities of 0.2°C and basically independent of the distance. Among others, AGA cameras and thermoprofile equipment are installed at the remote sensing center [OPOLiS] at the Institute of Geodesy and Cartography [IGiK].

Multispectral scanners are electronic devices with line data selection (scanning) which use photocells, television imaging and electric signals. There are no such scanners in Poland.

In modern remote sensing systems on a satellite, the information carrier is magnetic tape; data registered on the tape can be transmitted to the receiving station on the ground. Magnetic tape data can be visualized--using special converters--in the form of images (photographs).

Radiometers serve to measure the radiation emitted by objects being scanned. They are important for calibration and testing in situ to identify so-called spectral characteristics of objects. Radiometers of other types are used on satellites. For example, on the US NOAA-6 satellite, there is a high-resolution radiometer (AVHRR).

Active radar technologies operate in microwave bands. These are independent of weather conditions. Radars are mainly used in meteorology. In exploration of the earth, they serve mainly for geologic (structural) studies, although with development of these techniques they become increasingly useful also for studies of the terrain surface. Data recorded in radar technology appear as signals from antennae in the form of outlines or images (video radars). Examples of radars are the Soviet TOROS system (used for aerial exploration of Southern Poland--some 100,000 km<sup>2</sup>--for geological purposes), the sideways looking airborne radar SLAR, synthetic SAR radar on Seasat satellites and SIR-A imaging radar on the space shuttle Columbia.

#### Levels of Earth Data Collection

Three levels of data collection can be distinguished in remote sensing in studies of the earth: satellite, aerial and ground.

The satellite level embraces altitudes from 200 km to 1000 km and currently produces pictures of the earth's surface in scales of 1:1-1:3.5 million. The terrain resolution capacity of images taken from this level currently is 20-80 m. The first pictures of the earth from a large distance were made in 1946 from ballistic missiles using photographic cameras. Since 1963, earth pictures have been shot by unmanned Soviet Kosmos satellites. The Molniya satellite in 1966 used television cameras. In 1965-66, American Gemini spacecraft made color photographs of the earth with scales of 1:3 million to 1:10 million from 200-700 km. In 1969, the US Apollo-9 spacecraft for the first time made use of multispectral (four-channel) cameras. In 1973-74, a great number of photographs (mainly of the territory of the US and North America) were produced from the Skylab orbiters. Since 1972, US remote sensing Landsat satellites have been operating. Since 1976, Soviet Soyuz and Salyut craft (altitudes of about 250 km) have been using multispectral MKF-6 cameras. The scales are 1:1 million to 1:2 million.

Weather satellites have been in orbit even longer, since 1960.

Airborne remote sensing is done at an altitude range of about 20 km. Airplanes, helicopters, balloons and even radio-controlled airplane models are used for this purpose. The first photographs from an anchored balloon were made in 1950-60. In Poland, pictures are taken from airplanes from an altitude of up to 4 km, with scales 1:2,000-1:25,000. The resolution of aerial photographs is about 20 cm to 2.5 m on the terrain.

Ground measurements are necessary for calibration (testing) of aerial and satellite pictures. Radiometers and spectrometers are used to measure in situ the so-called spectral response of different objects. The ground level is also used independently for exploration and application of thermal technologies.

## The Principal Methods of Data Processing

In analog methods, man plays the main role. A specialist interprets (reads) the photographs and images, correlating the features of natural objects with their representations. The main feature of an image is its hue and color. Using the analog technique, over a dozen classes of objects are distinguished. The specialists make use of auxiliary equipment. Densitometers are used to measure the optical density of photographs. Stereoscopes and interpretoscopes are also applied. New devices are additive viewers that serve to make color compositions from various combinations of individual channels. Images are displayed on a monitor, from where they can be photographed. Artificial coloring is used quite commonly because of its higher "informativity" as compared to natural colors. Viewers also allow to collect automatically statistical data on identified objects. The OPOLIS-IGiK has such a viewer attached to electronic-analog converters made by the Japanese firm, NAC.

Digital (analytic) techniques limit the human role in image interpretation, replacing it with modern systems of remote sensing data conversion. The main elements of interactive data processing systems are: a converter allowing passage from an image to its magnetic tape record and vice versa; a computer-controlled device (operator keyboard, monitor) and output devices to print out the results or represent them in the form of drawing, photograph or map. The digital data processing is several times faster than the analog technique. Digital technology introduces geometric and radiometric corrections of images using a special program. With digital methods, various operations are feasible to extract data from images. These include such procedures as interchannel separation, image contrasting, image enhancement, composition from different channels (regions). For these operations, various mathematical functions are used, e.g., sine, polynomials and exponentials. For instance, the geological interpretation of satellite images of Krakow-Kielce region at the Geological Institute was carried out using sine contrasting.

The OPOLIS-IGiK uses the digital system supplied by the Canadian firm, OVAAC-Toronto. The system includes, among other things, a photomation converter from Optronics and the PDP-11/34 computer from DEC. The system can identify 64 object classes.

## Satellite Remote Sensing Systems for Earth Exploration

The current American satellite remote sensing system, based on unmanned Landsat satellites and a network of ground stations with automatic collection of data from satellites and presentation of this information on tapes and as images, operates on a commercial basis, supplying data to its clients. Recently, until 1982, the system used two satellites of the series--Landsat-2, launched in 1975, and Landsat-C, launched in 1978. The satellites move in circular orbits at an altitude of about 920 km, circling the earth 14 times every 24 hours; the equatorial shift of the orbits is 150 km, and every 18 days the satellite repeats its orbit. Landsat satellites view the earth's surface contained between 81° N lat and 81° S lat. The width of the viewing zone is 185 km, with the surface of each image being 34,000 km<sup>2</sup>. Poland's territory

is covered by 24 images from eight orbits. Two satellites provide images of the same terrain every nine days, provided favorable weather conditions. Poland lies within the range of the ground data collection station in Fucino near Rome. Landsat satellites use four-channel scanners (green, red and two infrared bands), with a resolution of 79 m, as well as television scanners with a resolution of 79 m (Landsat-2) and 40 m (Landsat-C).

In the USSR, initially, Fragment-2 system was introduced, which was based on the Meteor-Priroda satellite and three ground stations. In contrast, manned Soyuz and Salyut spacecrafts do not constitute a permanent remote sensing system, but are used for specific exploration of the earth in the framework of particular flight programs. One picture from Salyut covers a terrain of 20,000 km<sup>2</sup>. The resolution of these images is higher than that of Landsat.

Remote sensing technology is also used for other special purposes in weather and marine satellites (Meteosat, NOAA-6, and Seasat). Today, weather and telecommunication satellite networks are the best developed ones. From the point of view of their purpose, their most important advantage is immediate transmission of information.

#### Applications of Remote Sensing

In addition to meteorology, the following areas of remote sensing application and its main functions in individual areas are identified.

I. Geology and geomorphology: tectonic mapping, geomorphological mapping, discovery and location of mineral deposits and warm springs, either directly or indirectly based on photolineament analysis, geodynamic exploration (movement of tectonic plates, earthquakes, tectogenic surface movements), tentative siting of structures based on geologic-engineering features and glaciologic studies.

II. Hydrology and oceanography: water reserves and dynamics, location of subsurface water, studies of snow, ice and iceberg movement, bathometrics studies of seashore dynamics, exploration of microscale sea currents, detection of schools of fish.

III. Use of territories and space planning: mapping of current use of territories, statistics of territory usage, investigation of dynamics of land usage, study of microclimate in terms of urban development, specific maps for earlier development planning, such as thermal maps of cities, environmental protection zoning.

IV. Exploration and monitoring of the geographical environment: Determination of range and intensity of industrial air and surface pollution, study of water purity in reservoirs and flows, studies of threats and damages to vegetation caused by biotic and technogenic factors.

V. Farming and forestry: soil mapping, soil moisture studies, soil erosion studies, monitoring vegetation, status of crops and fields and their biotic and industrial damage, functional land reclamation studies, statistics of agricultural land use, crop harvest forecasts, study of the sanitary state of forests--detection of biotic and industrial damage to tree stands, detection of forest fires.

VI. Mining and certain aspects of engineering: detection and location of fires in old coal workings and dumps, control of sulfur production by underground melting, studies of the effects of mining operations--strip and underground mining--on large territories, studies of heat loss in conduits and buildings, studies of thermal characteristics of industrial furnaces and rotary kilns.

Importantly, remote sensing is a new area undergoing intensive development so that its applications are expanding rapidly. On the other hand, it does not abolish other conventional exploration methods, but generally serves to supplement and support them. Direct on-site studies are indispensable in remote sensing for calibration of remote observations and control of their reliability. Satellite and aerial remote sensing are applicable mainly to studies of rapidly changing phenomena on large territories, where direct observations may be inadequate. Remote sensing simplifies the use of the exploratory principle "from general to specific," providing valuable premises on which to determine the particular ground sites for study. The economic effect of remote sensing applications can be illustrated by the spectral method of remote sensing developed at IGIK to investigate tree damage which allows sparing six out of seven damaged trees cut with conventional techniques.

#### Remote Sensing in Poland

Interpretation of photographs has been developing in Poland based on aerial photogrammetry for over 15 years. From the early 1970's, studies in thermovision were started at IGIK. Since Jan 1, 1976, a remote sensing center has been operating at IGIK; it serves research and application purposes and has the basic equipment for analog and digital data processing. A broad spectrum of specialties is represented on the OPOLIS-IGIK staff (photogrammetrists, geologists, geodesists, electronic engineers, physicists, computer scientists, etc.). A large proportion of the staff received training at major foreign research centers and are experienced in basic and applied research. Altogether, about 120-150 scientists are engaged in remote sensing research in Poland. They are representatives of 12 disciplines, working at universities, institutes of government ministries and the Polish Academy of Sciences, as well as at some enterprises and civil and military services. Elements of remote sensing have been included in educational programs in geodesy-mapping and geography. The Geodesy and Cartography Department of the Warsaw Polytechnic Institute offers an interdisciplinary graduate course which involves the use of IGIK staff and equipment. Remote sensing publications appear in various periodicals, most frequently in PRACY IGIK, FOTOINTERPRETACJA W GEOGRAFII and PRZEGLAD GEODEZYJNY. Of books on

remote sensing published in Poland to date, one can mention: A. Ciolkosz, J. Miszański and J.R. Oledzki, "Interpretacja zdjęć lotniczych" [Interpretation of aerial photographs] (PWN, 1978); G. Rudowski, "Termowizja i jej zastosowanie" [Thermovision and its applications] (WkiL, 1978) and R. Kaczynski, S. Mroczek and J. Sanecki, "Rozpoznanie obrazowe" [Image recognition] (MON, 1982).

Up till now, IGiK has organized nationwide scientific symposia on remote sensing every two years. Specialists from foreign countries have also taken part in these workshops. The problems of remote sensing are discussed at national photointerpretation conferences organized by universities under the auspices of the Polish Geographical Society.

Aerial remote sensing photographs are produced by the State Geodetic-Cartographic Enterprise jointly with the Aerial Service Enterprises and the Topographic Services of the Polish Army in cooperation with the air force. Aerial photographs from higher altitudes are also made using equipment not available in Poland and obtained in the framework of the so-called subsatellite telephoto experiments conducted in selected regions of Poland under the Interkosmos program with the aid of Soviet AN-30 research aircraft. Photographs and magnetic tapes from Landsat satellites are collected at Fucino, Italy, ground station. Soviet satellite pictures of Polish territory are received under the contract signed by socialist nations. (Poland is represented by the Chief Administration for Geodesy and Cartography.) Also, these materials are received free of charge within the framework of the Interkosmos program.

In addition to Interkosmos, which includes a special remote sensing working group, international scientific and technical cooperation in this area is actively supported by Poland in the framework of geodetic and geologic services of socialist nations, within the framework of the UN (Committee for Peaceful Use of Outer Space, FAO and other agencies), and with nongovernmental international organizations (International Association for Photogrammetry and Remote Sensing, International Cartographic Association, International Astronautical Federation and the Committee on Space Research [COSPAR]). The remote sensing center of IGiK is linked by direct working contacts with its counterparts in Moscow, Budapest and Prague. Under the auspices of Polish and US ministries of agriculture, bilateral cooperation using remote sensing in forestry and farming is under way.

Poland's potential and experience in remote sensing enables it to provide expertise, education and perform specific projects for foreign clients. Specialists from IGiK have performed remote sensing studies from aircraft altitudes in Czechoslovakia, Hungary and Vietnam. IGiK and the Geological Institute, in a joint venture, have concluded the first contract for export in remote sensing signed by Geokart Export Enterprises and Polservice with Iraq's General Directorate of Geological Exploration.

A detailed review of remote sensing activities in Poland until 1981 is given in study by J. Bazynski, A. Ciolkosz, B. Ney and J. Walczewski, "Doświadczenia Polski w wykorzystaniu teledetekcji do badań i ochrony

zasobow naturalnych" [Polish experiences in applications of remote sensing for exploration and preservation of natural resources].

### Research Problems in Remote Sensing

Three basic trends of scientific basic and applied research for remote sensing can be identified:

- 1) the methods, techniques and systems for data collection and transmission;
- 2) the methods, techniques and systems for data processing; and
- 3) methodological principles of interpreting remote sensing data for the needs of users.

Studies in these directions are conducted in Poland mainly as part of research program 06.7, "Development and Application of Space Research" (first level coordinator is the Center of Space Research of the PAN), where remote sensing is included in subproblem 4 (second level coordinator IGiK), as well as in Interkosmos and generally in remote sensing research worldwide. Because of the interdisciplinary nature of remote sensing, this research is conducted by scientists in various fields based on their particular results, mainly in basic research and design. Close links to practical applications are a characteristic trait of this research.

The first two research trends belong to technical and exact disciplines, particularly electronics, cybernetics and technical physics. Earth sciences are predominant in studies of the third trend, although with participation of physicists and computer scientists, as well as specialists in agriculture, forestry, biology, etc. Of specific problems investigated here, the following may be noted: the cause-effect relationships between characteristics of objects and natural phenomena and images of these features on remote sensing information carriers, establishing so-called interpretive keys based on studies of spectral characteristics of objects, theory of final errors of remote sensing data, taking into account the complete cycle: search-processing-interpretation, methods and techniques of specific interpretation of output data, information systems using remote sensing data and others, and methods and systems of environmental observation. Currently, Polish research in methodology of the principles of specialized remote sensing data interpretation is conducted in the following fields: geology, regional planning, environmental protection, water management, agriculture, forestry and marine technology. Since maps are the main form of presentation of remote sensing data, special cartography has a major place in this research.

### Prospects of Further Development of Remote Sensing

The following tendencies in the development of remote sensing can be identified:

- 1) improved separation of remote sensing data to broaden the method's applications;



- 2) surmounting the influences of weather conditions by development of radar technologies, introduction of proper corrections, etc.;
- 3) speeding up the entire process from data interrogation to data use towards real time or minimum delay performance in relation to rapidly varying conditions (this has already been attained in space and weather communications);
- 4) development and operative implementation of automated satellite remote sensing systems;
- 5) development and operation of comprehensive remote sensing research programs for science and practical application; and
- 6) improved interpretation of remote sensing data to ensure reliability (high probability of correctness) and routine execution.

In the nearest future, an enhanced system of satellite remote sensing will be essential. In 1983, the next Landsat satellite, denoted by the symbol D, will be brought into full operation; it was launched in 1982 (elevation of about 700 km). Landsat-D is equipped, in addition to a four-region scanner, with the new seven-channel TM (thematic mapper) unit, which has two green channels, one red channel, three near-infrared or photographic, and one thermal infrared channel. The resolution capacity of the TM is 30 m on the ground. Landsat-D will transmit daily 750 images (scenes), including 500 from the scanner and 250 from the TM, compared with 190 images transmitted by Landsat-C.

The next important step will be the French remote sensing satellite SPOT (an orbit of about 830 km), to be launched in 1984 and brought into practical exploitation in 1985. The SPOT satellite will use a four-channel scanner with panchromatic ground resolution of 10 m, capable of producing a digital model of the terrain due to operation of practical stereoscopic effects. The remaining channels, complete with thermal infrared, will feature a resolution of 20 m.

In 1987, the European Space Agency (ESA) plans to put into orbit its ERS satellite for study of earth's reserves, equipped in addition with an altimetric unit for global monitoring of movements and pulsations of the earth's crust and the oceans.

Another factor is the development of Soviet remote sensing satellite system to be based on the Fragment experiment already in progress.

At the Second UN Conference on Exploration and Peaceful Uses of Space (Vienna, Sep 1982), the American agency, NASA, presented a comprehensive program of satellite study of human life on earth, including, among other things, such elements as demographics, environment, weather conditions, food reserves, etc.

The Geosat organization worked out and implemented a program entitled "Global Satellite Remote Sensing for Studies of Energy Minerals and Other Reserves," aimed specifically at oil, gas, uranium and copper prospecting

both on continentals and under the seas. Participants in the program included American and French institutions, using existing and projected satellite systems such as Landsat, ERS, MOS (the Japanese satellite for marine research; planned launch in 1987).

The development of remote sensing is impossible without broad international cooperation. The above-mentioned Second UN Conference expressed this in its resolution, emphasizing peaceful uses of space, which belongs to all mankind, so that economic benefits of remote sensing contribute more than before to developing nations, and noted the role and forms of international cooperation in the UN framework and the forum of nongovernmental international organizations.

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